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Plant Breeding Abstracts

Vol. II, No. 2.

Part I. British Empire

GENETICS 575

160. BAUR, E. 575.24:576.12

Evolution.

J. Roy. Hort. Soc. Lond. 1931 : 56 : 176-82.

The untenable nature of Lamarckism is discussed and the limited possibilities of combination of characters to produce the material for natural selection. The frequency of mutation has been under-estimated because the majority of mutations are recessive and hence masked and the author is of the opinion that it is the small mutations which provide the material for natural selection within the genera.

The *Antirrhinum* work has shewn that the greater the number of characters (genes) in which two species differ, the less does their interfertility tend to be. This, together with chromosome differences, gives the possibility of the evolution of very sharply distinct groups.

The author has also shewn that quite slight environmental changes, such as are likely to occur in nature, are sufficient to increase the mutation rate.

161. HURST, C. C. 576.16

The species concept.

Gdnrs.' Chron. 1930 : 88 : 325-26.

The concept of the species, since the arrival of the cyto-genetic outlook, has at last been placed on a sound basis and attention is drawn to a number of cases where the new concept has succeeded in solving previous difficulties. The number of species is as a result tending to be greatly reduced, the old species have been brought together into uniform groups and many now rank as sub-species. The reality of this grouping is amply illustrated by the results of hybridization, which together with chromosome studies have become the chief criteria of a species.

ECONOMIC PLANTS 633/5

162. ENGLEDDOW, F. L. 633:575

Plant-breeding ; its practices and scientific evolution.

Sci. J. Roy. Coll. Sci. Lond. 1931 : 1 : 74-95.

The objects and scope of plant breeding are outlined in some detail. The three methods of plant breeding—introduction, selection, hybridization—are described and outstanding examples of their success quoted.

The vegetatively propagated crops are discussed separately, with reference to the retention of valuable heterozygous types and the influence of the rootstock ; hybrid vigour is also discussed in this connection and in general.

A number of genetical problems which impinge on plant breeding are discussed. Amongst these are questions relating to chromosome aberrations and interspecific crosses involving differences in chromosome number.

The complexity and consequent difficulty of manipulation of nearly all economic plant characters are emphasized.

163. BAUR, E. 633:575(43)
Scope and methods of plant-breeding work at the Kaiser Wilhelm-Institut für Züchtungsforschung, Müncheberg (Mark).
 J. Roy. Hort. Soc. Lond. 1931 : 56 : 183-90.

The time-honoured method of breeding by selection is used in the case of lupins, which would constitute a very valuable legume for the light soils if strains free from bitter alkaloids could be evolved. A method has been discovered for testing the presence of these and amongst over a million plants one or two plants of *Lupinus luteus* and *L. angustifolius* were discovered in which the alkaloids were absent. These sweet lupins are in course of propagation. By similar methods nicotine-free tobacco plants have been found.

Under cross-breeding the methods of transgression and of recombination are discussed and examples given. One of the major problems in Germany is to procure a wheat capable of cultivation in the rye tracts and crosses of bread wheats with other species and with rye or *Aegilops* bid fair to produce this. The method consists of growing the mixed hybrid population repeatedly on very poor soil. Selection begins in the ninth generation when most plants have reached homozygosity.

Such methods are being applied also to crosses of *Vitis vinifera* with wild American resistant species, of cultivated potatoes with the wild species recently discovered in Bolivia and Peru, between European and American species of *Ribes* and different species of other fruit trees, tomatoes, etc.

The chief emphasis is laid on the value of wild types for introducing certain desirable characters and the consequent necessity for working with exceedingly large numbers.

The production as a result of induced mutation of valuable characters hitherto unknown in a particular crop plant is now entering the field of practical breeding and experiments on these lines have been started at Müncheberg.

164. DAVIES, J. 633.00.14-1.421
The experimental error of the yield from small plots of "natural" pasture.

Report on Co-operative Investigations at the Waite Agricultural Research Institute. Bull. Counc. Sci. Ind. Res. Aust. 1931 : 48.

This is a statistical study of the air-dry weights resulting from the harvesting of 760 plots, each 1/2000 acre, of typical natural pasture. Studied individually, and in various combinations, the data furnished figures for the standard error, as a percentage of the mean, of plots of varying size and shape. In addition botanical notes were made which enabled the unit plots to be divided into a number of sets, each having one of four species dominant. The conclusions are : (1) the experimental error is much higher than for crops like wheat, mangolds, etc., for which similar investigations have been carried out, (2) increasing the size of plot reduces the standard error, but not to the extent expected from theoretical considerations (the author has not, however, taken into account the correlation which probably exists between the plots aggregated), (3) the optimum size of plot is one of 450 square links (5 x 90), for which the standard error is 13.78% (this includes all soil variation, which has not been eliminated as between groups of plots) (4) a long narrow plot appears to be more efficient in reducing the error than a square, or nearly square, plot of the same area, (as the plots were elongated in one direction only, the information is not complete on this point), (5) below a certain minimum size of plot the distribution of yield is not normal, possibly due to the occurrence of "societies" of particular dominant species, the partial distributions of which are shown to be far from normal.

165. HALL, A. D., RUSSELL, E. J. ET AL. 633.0014-1.421
The technique of field experiments.
 Being the report of a conference held at Rothamsted on May 7th, 1931.
 Rothamsted Expt. Sta. Conf. 1931 : No. 13 : 64 pp.

166. HARRINGTON, J. B. 633.11:575.127.2:581.141
The relationship between endosperm development and morphologic characters in the F_2 generation of a *T. dicoccum* x *T. vulgare* cross.
 Canad. J. Res. 1931 : 5 : 208-18.

The F_2 seed of the cross Vernal (*T. dicoccum*) x Marquis (*T. vulgare*) was divided into three groups, A, B, and C, according to plumpness, and the resulting plants compared on the basis of thirteen morphological characters. Germination was much the same for the three groups but the seedling emergence was 64, 58 and 36 per cent for the "plump," "slightly shrunken" and "shrunken" groups respectively.

As a whole A tended to be more *dicoccum*-like and B more *vulgare*-like but B was more *dicoccum*-like than C. Within the groups the average ratio of *dicoccum*-like plants to *vulgare*-like plants was 12.1:1 for A, 5.3:1 for B and 2.2:1 for C.

Analysis shows that for the breeder with a limited amount of seed the shrunken seeds are of importance but that where a large quantity can be grown, on account of the poor development of the C group, the desired *vulgare*-like plants may be obtained from the other groups.

167. AAMODT, O. S. 633.11-2.451.3-1.521.6:575
Varietal trials, physiologic specialization and breeding spring wheats for resistance to *Tilletia tritici* and *T. levis*.
 Canad. J. Res. 1931 : 5 : 501-28.

Tests of a number of varieties shewed that the recently introduced rust-resistant varieties are highly susceptible to both species of the smut. These varieties have as a consequence also served to increase the prevalence of the fungus. The recent appearance and spread of certain new and very virulent physiological forms has aggravated the position. These questions are discussed in the first half of the paper.

The experimental methods are described in some detail, together with the reaction of the differential hosts used and a number of the commonly cultivated varieties. None of these was truly resistant. Temperature differences are shewn to alter both the virulence of the different forms and the reaction of the different varieties. The ratios in F_2 were judged on the basis of the reaction of the F_3 lines.

Nine different crosses were made and large F_3 populations studied. In every cross certain lines transgressed the parental limits; this was particularly marked in a cross between two moderately resistant parents, the transgression being in the direction of greater susceptibility. It is clear that the inheritance is controlled by multiple factors and strong hopes are held out for the production of resistant varieties.

168. WESTON, W. A. R. DILLON 633.11-2.452:535.61-35
The effect of ultra-violet radiation on the urediniospores of some physiologic forms of *P. graminis tritici*.
 Sci. Agric. 1931 : 12 : 81-87.

Certain of the recessive colour mutants previously reported (Plant Breeding Abstracts, Vol. I, Abst. 107) are shewn to be more susceptible to ultra-violet rays than the normal fully coloured forms; these are the ones in which the pigment in the spore wall is involved.

169. PETERSON, R. F. 633.11-2.452-1.521.6:575:581.49
Stomatal behaviour in relation to the breeding of wheat for resistance to stem rust.
 Sci. Agric. 1931 : 12 : 155-73.

It has been suggested that the mature plant resistance characteristic of H-44-24 and other varieties is caused by the delayed opening of the stomata, which prevents the entry of the fungus. A study is presented of the stomatal behaviour of a number of wheat varieties and hybrids. No clear association was evident between resistance and stomatal behaviour, especially in the hybrid population which segregated very clearly for resistance.

Plants were inoculated in the dark when their stomata were closed ; in the seedling stage infection was produced under these conditions but infection was increasingly difficult with the plants of the mature plant resistance types, as they became older, although full infection could still be obtained with Marquis. The author concludes that they develop a physiological resistance as they approach maturity, independently of light and stomatal effects. No reduction in mature plant resistance was produced by spraying the plants with soft water at the time when their dew covering is normally evaporated, and so prolonging the conditions suitable for infection till after the opening of the stomata.

170. NEATBY, K. W. 633.11-2.452-1.521.6:576.16:575.11
Factor relations in wheat for resistance to groups of physiologic forms of *Puccinia graminis tritici*.
 Sci. Agric. 1931 : 12 : 130-54.

In the cross Marquis x H-44-24 there was a distinct correlation between the type of reaction to different forms of the same group, suggesting that resistance to the whole group is governed by one factor. The factor in Marquis upon which its high resistance to form 14 depends is also shewn to govern susceptibility to form 21 ; from a practical view point, however, this has ceased to be of importance, since the partial resistance of H-44-24 is sufficient.

The 15 forms under investigation fall into three groups ; there appear to be two sets of factors, one of which controls group II and the other group III ; group I is controlled by both sets of factors. Each set seems to consist of one factor only.

Substituting Marquillo for Marquis a more complicated condition is produced. Three distinct factor sets are evident, conditioning the reaction to two or possibly more groups of rust forms.

A complicated condition also obtained in the cross Garnet x Double Cross. There are two groups of forms controlled by distinct factor sets, a third group controlled by both of these sets ; a further group is also indicated.

The mature plant resistance of H-44-24 was inherited independently of these seedling reaction factors in the cross with Marquis. In the crosses with Marquillo there was a strong correlation between greenhouse and field reaction to certain forms, evidently conditioned by the Marquillo factors. In the third cross no factor operated for field resistance apart from those identified for seedling reaction.

It is pointed out that the grouping of the forms is different in the different crosses. This, together with the fact that no form has yet been found to attack in the field those varieties possessing mature plant resistance leads the author to conclude that studies of physiological forms will pass out of practical breeding.

171. HARRINGTON, J. B. 633.11-2.452-1.521.6:581.036
The effect of temperature on the expression of factors governing rust reaction in a cross between two varieties of *Triticum vulgare*.
 Canad. J. Res. 1931 : 5 : 200-07.

Many authors have found that resistance to certain physiological forms varied according to the temperature at which the plants were grown. In this case the effect in the F_2 of a cross Marquillo x Marquis was tested on the seedling F_2 at temperatures averaging in one case 70° C. and in the other 60.6° C. In each experiment Marquis was susceptible and Marquillo resistant to form 21 of *Puccinia graminis tritici*. At 70° C. only eleven families were resistant out of 781 and 60° C. only five families were susceptible out of 301. The numbers in each case shewed an excellent fit to a 63 : 1 ratio indicating three main factors, though dominance and recessiveness were reversed.

The following hypothesis is proposed : Marquis and the F_1 of the cross with Marquillo are susceptible, therefore Marquis is AABBC and these factors when all are present in the homozygous condition cause susceptibility at 61° or 70° or resistance in their complete absence. It is also assumed that the action of these factors is reduced at moderately low temperatures so that,

for instance, the complete heterozygote AaBbCc would be very susceptible at the higher temperature but at the lower would shew only very little susceptibility. The results are in good agreement.

The possibility is pointed out that some factors controlling rust reaction may be susceptible to temperature—others not, which may much complicate the problem.

The importance to the breeder of a knowledge of the behaviour of the resistance of the various hybrids or strains to conditions of temperature is stressed and also the need for experiments under controlled conditions.

172. RANGASWAMI AYYANGAR, G. N. and KRISHNA RAO, P. 633.17:575.11.061.6

The inheritance of characters in ragi, *Eleusine coracana* (Gaertn), 1.

Purple pigmentation.

Ind. J. Agric. Sci. 1931 : 1 : 434-44.

The purple pigmentation is one of the major characters for the classification of the species. The manifestation of the pigment is described. Three types are distinguished, viz. purple, "dilute" purple and "localized" purple.

The author concludes that the latter is the basic type, possessing the factors for pigmentation, PP, in whose absence the plant is entirely green. An intensifier I₁ is postulated, giving dilute purple, and a second intensifier I₂ which in presence of P and I gives full purple.

The evidence from which these conclusions are drawn is tabulated.

173. RANGASWAMI AYYANGAR, G. N. and PANDURANGA RAO, V. 633.17:581.162.3

Studies in Sorghum I. Anthesis and pollination.

Ind. J. Agric. Sci. 1931 : 1 : 445-54.

The course of anthesis has been observed in some detail for six varieties, including varieties of *Sorghum Durra*, *S. Roxburghii* and *S. nervosum*. A description of the observations and of the components of the ear-head is here given and the observations compared with those of previous writers. The plant displays a certain tendency to natural cross-fertilization.

174. RAMIAH, K. 633.18:581.162.5:575

Preliminary investigations on the occurrence of sterility in rice

(*O. sativa*).

Agric. and Live-Stock in India 1931 : 1 : 414-26.

The form of sterility in which a number of otherwise normal spikelets distributed throughout the panicle fail to set grain is studied. Adverse environmental conditions increase the sterility and it may occur as the result of a cross between apparently normally fertile parents. Some association of sterility was found with the presence of anthocyanin in the leaf axil and stigma, with green as against purple glumes, the degree of emergence of the panicle and size of grain.

Sterility was found to occur most in the last developing panicles and to be confined to the basal portions of the panicle.

Pollen abortion and the failure of the pollen grains to germinate are among the factors causing sterility.

175. GORMAN, M. J. and LAFFERTY, H. A. 633.42-1.547.25

On a method of distinguishing the seedlings of Swedish turnip [*Brassica napus* L. var. *napobrassica* (L.) Reichb.] from those of rape [*Brassica napus* L. var. *biennis* (Schübl et Mart.) Reichb.]

Sci. Proc. Roy. Dublin Soc. 1931 : 20 : (N. S.) : 119-24.

When seeds of broad-leaved rape and yellow-fleshed swedes were germinated under identical conditions the rape seedlings were darker green and two clear morphological differences in the first foliage leaf also exist, by which the identity of the seedlings can be accurately determined.

176. **NYE, G. W.** 633.51:575(67.61)
A short account of the history and development of cotton in Uganda.
Emp. Cott. Grow. Rev. 1931 : 8 : 282-90.
A description of the gradual improvement of cotton by the introduction of new types resulting from selection. The introduction of new types with the incomplete eradication of the older ones has led to a very mixed population which should form a valuable basis for renewed selection.
177. **FIKRY, M. A.** 633.51:581.162.32
Natural crossing in cotton.
Bull. Roy. Agric. Soc. (Tech. Sec.) Egypt 1931 : 18 : 23 pp.
The various factors affecting self and cross-pollination are briefly discussed. The method used to test cross-pollination was the number of plants with red leaves in the progeny of green-leaved plants, a plantation of which had had a strip of Red Leaf Acala planted in the middle. The percentage of natural crossing fell to zero at a distance of 40 m. from the source of foreign pollen. The amount fell off regularly in all directions, indicating that the wind played little part.
The average percentage of crossing in one plant from all plants both north and south of it was calculated as 4.05.
178. **Cotton improvement in India.** 633.51.00.15(54)
Ind. Centr. Cotton Comm., Bombay, 1931.
An account in summary form of the advances and results obtained under the auspices of the Committee and the programme for future work.
179. **NUTMAN, F. J.** 633.526.23
The field for sisal research in East Africa.
Bull. Imp. Inst. London 1931 : 29 : 299-307.
A review of the various problems which research may be expected to solve.
Some thousands of seedlings have already been raised at Amani and are being studied. Fruit has never been seen to develop on uncut poles. Certain suggestions as to the reasons for the failure to set seed in uninjured plants and in plants grown in the plains are offered.
180. **DODDS, H. H. and FOWLIE, P.** 633.61(68.4)
Sugar cane research in Natal and Zululand. Field trials of varieties at Mt. Edgecombe, the Natal Sugar Experiment Station.
Int. Sug. J. 1931 : 33 : 433-34.
From one series of experiments a comparison was made of five varieties already grown for some years in Natal. Uba and P.O.J. 213 proved most suitable to the conditions, the latter remaining free from mosaic and highly resistant to streak disease.
In the other series, newly introduced varieties were tested and some of the Coimbatore varieties seemed likely to supersede Uba.
181. **VENKATRAMAN, T. S.** 633.61:575.127:633.62
Sugar cane sorghum hybrids. An appeal for seeds of wild sorghum.
Int. Sug. J. 1931 : 33 : p. 433.
In view of the success of the sugar cane x sorghum hybrids in producing a quick maturing cane an attempt is being made to increase the vigour not only by crossing with sugar cane but also if possible by the use of the more vigorous sorghums. For this purpose the seed of suitable wild sorghum is desired.

182. 633.63:575

How beet seed is bred.

Brit. Sug. Beet Rev., 1931 : 5 : 37-39.

A description of the methods used in breeding by the firm Kuhn and Co. in Holland. Inbreeding followed by crossing of the inbred strains is now adopted and the system is briefly described.

183. 633.73

Coffee.

19th Rep. Imp. Econ. Comm. London 1931.

In the section on research it is remarked that an effort must be made by breeding to increase the size of the Kenya bean, without sacrificing liquoring quality. Reference is made to the scale on which breeding is now being done in the Empire and the enormous improvement which may be expected from it.

184. 634.0015

FREEMAN, W. G.

Tropical and sub-tropical fruit industry. Difficulties encountered and lines of attack.

Proc. 1st Imp. Hort. Conf. London 1930 : Pt. II, 27-32.

A very brief indication of research work done on avocado, mango, banana, cacao.

185. 634.11-2.42-1.521.6

JOHNSTONE, K. H.

Observations on the varietal resistance of the apple to scab (*Venturia inaequalis*, Aderh.) with special reference to its physiological aspects.

Part II.

J. Pom. Hort. Sci. 1931 : 9 : 195-227.

With wide variations a greater toxicity to the fungus was found in the liquid expressed from resistant varieties.

186. 634.3/6:575

FREEMAN, W. G.

The selection and breeding of tropical tree crops.

Sci. J. Roy. Coll. Sci. Lond. 1931 : 1 : 96-101.

Examples are given of successful cases of breeding for quality in citrus, mango and avocado and the discovery of wide differences in productivity from tree to tree in cacao, coconut, citrus and *Hevea* and the transmission of these differences to the seedling or budded progeny.

Part II. Foreign.

GENETICS 575

187. EULER, H. ET AL. 575.061.6:581.192
Zur chemischen Charakterisierung von erblichen Chlorophylldefekten. (The chemical characterization of heritable chlorophyll defects.)
Z. indukt. Abstamm.- u. VererbLehre. 1931 : 59 : 131-52.

A study was made of the qualitative and quantitative differences between normal and chlorophyll deficient mutants in barley seedlings. The catalase, peroxydase, starch, sugar and magnesium contents of normal and deficient were compared.

The albinos of one strain shewed a marked reduction in catalase content but no clear differences in peroxydase, starch or sugar content. The green seedlings however, contained about 40 per cent more total Mg. than the chlorophyll deficient seedlings.

The light-green mutants of another strain did not shew a regular reduction in catalase content. There was no difference in catalase content between homo- and heterozygotes.

188. SIRKS, M. J. 575.113.3:635.651
575.113.4

Quantitatieve erfelijkheid. (Quantitative inheritance.)

XXIII Nederl. Natuur-en Geneesk. Congres, Delft 7-9 April 1931, Biolog. Sectie.

The question of "polymery" or multiple factors is discussed and it is pointed out that one of the dangers of the principle is that with its aid, together with that of linkage, any ratio whatever can be "explained." Moreover, it is improbable that, as is so often assumed, all the factors governing a particular character are alike.

The author's work on *Vicia faba* has shewn that a group of four multiple allelomorphs is fundamentally responsible for the dimensions of stem, leaf, fruit and seed. In addition to this, for the stem there is a second group of multiple allelomorphs, for the leaf a single factor pair for width, a distinct pair for length and a triple allelomorphic series for the length of the terminal section of the leaf. The fruit width is influenced by certain of these same factors, the fruit length by others. The seed dimensions are influenced by the same factors as the leaf, with various complications. Moreover reciprocal crosses between *V. faba major* and *V. faba minor* have shewn that the same factor may react differently in different plasmas.

Growth curves for the various genotypes have shewn that the genes influence the rate of growth ; plants of the same genetical constitution have identical growth curves.

These facts are significant in the light of the quantitative enzyme theory of multiple allelomorphs.

The author questions whether each gene in the allelomorphic series always remains pure on hybridization and suggests the possibility of some sort of molecular interchange.

The author thinks it probable that the phenomenon of multiple factors may be limited to polyploids.

189. RICHEY, F. D. 575.125:633.15
Experiments on hybrid vigor and convergent improvement in corn.
Tech. Bull. U.S. Dept. Agric. 1931 : 267 : 22 pp.

Two lines which on crossing displayed pronounced hybrid vigour were chosen. Certain of the F_1 plants were back-pollinated with one of the parents, the best of the resulting plants were again back-pollinated and so on over a number of generations, the same parent being used recurrently. This series was compared in yield with a similar theoretical series for plants back-crossed without selection, based on the assumption that each successive back-cross reduces the degree of heterozygosity and hence the degree of hybrid vigour ; this was shewn to be the case in the first back-cross. In all cases the yields of the selected plants were higher, shewing that

their composition was more like that of the non-recurrent parent and thus of the F_1 , than that of unselected back-crossed plants.

Another experiment considers the theoretical yields of F_1 's obtained by crossing lines, resulting from varying generations of back-pollinating, with the non-recurrent parent; this series gradually approaches the yield of the original F_1 . It is compared with a similar series using the selected plants from back-pollinating. Here again the results obtained with selection are in excess of the theoretical; after three generations of back-pollination the results were almost equal to the original F_1 and after four generations they exceeded it.

These results are definitely in opposition to the theory that heterozygosis as such is responsible for the phenomenon of hybrid vigour, since the crosses between the selected back-pollinated lines and the non-recurrent parents are less heterozygous than those from unselected lines. This view is supported by the fact that F_1 's between some of the extracted lines after three or four generations of back-pollination, although consequently less heterozygous than the original F_1 , also out-yielded it. The results definitely support the hypothesis of dominant genes.

The advantages of so reducing the number of back-pollinations required before beginning a new cycle of convergent improvement are pointed out and the author calls attention to the possibility of fixing the selected intermediate lines containing some of the dominant genes of each parent, thus bringing about a permanent increase in vigour. It seems possible moreover that the yields of hybrids between selfed lines may be raised still further.

The back-crossing method has succeeded in introducing a number of other desired characters into the lines in question.

190. OELKERS, F. 575.24
Der gegenwärtige Stand der Mutationsforschung. (The present position
of research on mutation.)
Ber. deuts. Bot. Ges. 1931: 49: 29-45.

The author begins with a brief review of the historical development of the mutation theory. The mutation concept is discussed; the methods of investigation are shown to be dependent on the type of mutation—factor, chromosome, plasmon mutation.

The study of spontaneous mutations has shown that factor mutations can occur in any cell, chromosome mutations tend to occur only in the germ cells. Some plants appear to be pre-disposed to the one type and other plants to the other type.

Chromosome mutations can be readily produced by a variety of agencies. Factor mutations are much more difficult to induce but success has been attained recently.

It is significant that although the three types of mutation represent processes so essentially different, their artificial induction depends on similar agencies. These must therefore have only an indirect effect in stimulating mutation.

The absence of a direct quantitative effect of changes in the genomic material on chromosome mutation is discussed.

Most recessive mutants seem to occur quite at random, dominant mutants which once occur tend to occur repeatedly. The majority of recessive mutant genes are stable, a certain number show a constant tendency to revert. This again indicates that it is not the mutation process but the condition of the gene which has been affected. This seems to be closely connected with the phenomenon of labile genes. It is suggested that the multiple series produced by some of these are due to successive quantitative losses of gene substance which result in qualitative expression as multiple allelomorphs.

The question of the production of culturally superior characters by mutation is now being put to practical test.

191. BRITTINGHAM, W. H. 575.243:539.16
Variations in the evening primrose induced by radium.
Science 1931: 74: 463-64.

A brief description and discussion of the types obtained

192. STEIN, E. 575.243:632
Erblicher Pflanzenkrebs als künstliche Mutation. (**Inheritable plant warts as an artificial mutation.**)
Eugenik 1931 : 1 : p. 125.

A disease is described which was brought about by irradiation with radium. The disease was hereditary and consisted of a collection of adverse mutations resulting from the irradiation.

193. DANIEL, L. 575.257
Sur la descendance du soleil annuel greffé sur topinambour. (**On the progeny of annual sunflower grafted on to Jerusalem artichoke.**)
C. R. Acad. Sci. Paris 1931 : 193 : 473-75.

A number of abnormalities in fruit type in the fruits of the scion are mentioned. There were also certain abnormalities in the cotyledons and of the later leaves.

194. HABERLANDT, G. 575.257
Was sind die Crataegomespili? (**What are Crataegomespili?**)
Biol. Zbl. 1931 : 51 : 253-59.

See Plant Breeding Abstracts, Vol. I, Abst. 289.

195. VAVILOV, N. I. 576.16
(**The Linnean species as a system.**)
Bull. Appl. Bot. Genet. and Plant-Breed. 1931 : 26 (3) : 109-34.

An examination of very large numbers of species has shewn that every one is composed of a number of forms or genotypes. A remarkable similarity has been disclosed in the process of development of forms or varieties within the different species. These latter are closely related genetically and cross with ease. Quite often there is to be observed a parallelism of variation in nearly related species or genera of whole families. Thus a large collection of wheat material from Abyssinia disclosed a striking parallelism between the hard 28-chromosome wheats and the soft 42-chromosome wheats—durums without awns and without ligules were found. Liguleless forms have now been discovered in all cereals except barley.

A similar parallelism was disclosed in the 14 and 42 chromosome oats found in Portugal in 1927. Frequently these characters display a genetic as well as phenotypic similarity, corresponding characters displaying the same dominance relations. The more nearly related species and genera display a closer parallelism than more distant ones. It is thought that the "form-originating" processes have pursued a parallel course during the history of the species, the parallelism being not absolute, since some genes have of necessity tended to be lost.

The detailed examination of species from this point of view has led to the detection of an enormous number of varieties previously unknown and some of great practical value.

An investigation of the hereditary variability of species has shewn that certain varieties may be characteristic of some districts and rare or absent in others. It is impossible to make a study of any species therefore without possessing material from all regions where the species is encountered.

The Linnean species is, as a result of these studies, regarded as a complicated system of forms, obeying the "law of homologous series."

Polymorphism has frequently been revealed in ordinarily cross-fertilized species by subjecting them to inbreeding. So, for instance, by this means forms have appeared in rye which were previously unknown and did not occur even in the centre of distribution. Polymorphism has also been disclosed through the agency of X-rays, etc., as in maize and many other plants, and by crossing an apparently outwardly homogeneous form with recessives, whole series of new forms and genes have come to light. This has occurred even with *Pisum*, on crossing Afghan and Abyssinian forms with recessive European forms.

One of the most important problems in studying any linneon is to determine the primary basal area of its distribution, where it has originated and is now found in greatest variety. This principle is illustrated with reference to *Avena brevis* and *A. strigosa*—the latter has been known over a wide area of Europe but only two to three varieties, whilst in a very restricted area in Portugal and North-west Spain a whole wealth of forms, previously unknown, was discovered. The same was found for *A. brevis* and others of the 14-chromosome group in the Pyrenees; the "form-originating processes" are thought to have been found *in statu nascendi*. Similar revelations have been made for many commonly cultivated plants; in some of these perfectly "good" new Linnean species have been established, notably in the case of the potato. In place of three sub-species (botanical forms) of rye, over ten have thus been found, in lentils fifty-eight in place of five; similarly for fruit trees and many other plants, whilst the whole systematics of the Cucurbitaceae has had to be revised.

The centres of distribution frequently coincide with the centres of intraspecific polymorphism, sometimes however they do not.

The climate plays a very important part in the individualization of ecotypes within the species. The gradual separation of recessive forms towards the periphery of distribution of so many species is discussed. The differentiation of recessive forms often occurs in secondary centres of "form origin."

For the definition of a species it is necessary to take into consideration the morphological, physiological, geographical and ecological features and the question of sterility. There is no uniformity in the Linnean species, some being large and complicated systems, others comparatively small and well-defined.

The principles are illustrated with reference to the genus *Triticum* and it is shewn that the three groups (linneons) are quite distinct from the point of view of interfertility, etc., and that they also have distinct centres of origin; yet each can be divided into large numbers of clearly defined sub-species. The limits between these are sometimes ill-defined, quite often as a result of the intervention of man in producing intermediate forms.

196. NABOURS, R. 576.16:575.12
Emergent evolution and hybridism.
Science 1931 : 71 : 371-75.

The author regards the increase in variability resulting from hybridization as sufficient to afford the material upon which natural selection has worked.

BOTANY 581

197. YASUDA, S. 581.162.5
An experiment to graft the style upon the ovary in *Petunia violacea*.
Proc. Imp. Acad. Tokyo 1931 : 7 : 672-75.

The results shewed that the inhibition to the growth of the pollen tube depends on the ovary and not on the style.

198. GOTOH, K. 581.331.23
Physiological researches on pollen, with special reference to the artificial germination of Gramineae pollen.
Mem. Fac. Sci. and Agric. Taihoku Imp. Univ. 1931 : 3 : Bot. No. 3 : 61-197.

The effect of various cations and other factors on the germination and bursting of pollen is studied.

The rate of growth of the pollen tube increased almost proportionally with the chromosome number in the case of autopolyploidy but not in the case of allopolyploidy.

The physiology of growth of the pollen tubes in the stigma is studied. The strength of the chemotropic effect of the stigma secretion on this growth is different in different species of plants. Dried pollen grains, after recovering turgidity in a moist chamber, in certain cases germinated better than fresh pollen grains.

199. : POPOV, M. G. 581.9(51.7 + 55).
[Between Mongolia and Iran. (The main botanico-geographical features of Sinkiang, the westernmost province of China, according to the author's own investigations in 1929 and to literary data on the country.)]

Bull. Appl. Bot. Genet. and Plant-Breed. 1931 : 26 (3) : 45-84.

The geographical features of the countries are described, together with the plants found. These are very scanty and consist of alpine or desert forms, the flora is in no particular way different from that of the surrounding countries. The region is almost uninfluenced by the flora of Central Asia, many genera characteristic of Central Asia being entirely absent. This applies both to the wild flora and the weed flora of the cultivated areas.

The explanation offered for this extreme poverty is that the region is completely enclosed by very high mountains which must have acted as a barrier against the entry of flora from Central Asia or India.

200. : CHERNYAKOVSKAYA, E. G. 581.9(55).
(Khorassan and Seistan).

Bull. Appl. Bot. Genet. and Plant-Breed. 1930 : 23 (5) : 3-271.

Drought resistant and early forms of a number of crops exist in Persia and are of great value for Russian conditions or for hybridization. Expeditions were therefore sent there to collect wild and locally cultivated types.

The general character of the country is described and an account given of the plants found in the various regions. After this the cultivated plants are taken in turn and the main types occurring and their proportions are indicated. The authoress in this way deals with wheat, barley, *Panicum italicum*, maize. In the latter the male and female flowers tend to flower at the same time, resulting in a tendency towards self-pollination; the plants are low and develop a large number of cobs per plant, together with other valuable characters for dry regions and not present in American varieties. Cotton was found in considerable variety, both Upland and African types being found; the former, *Gossypium hirsutum*, were remarkably late-ripening and low-yielding; the latter, *G. herbaceum*, were more varied with regard to a number of characters, which are enumerated—the majority are second-rate but certain ones had a lint length of 32 mm. and a lint percentage of 30 and over. Another important crop is the melon. Descriptions are given of a large number of the prevalent types, cultivated and wild.

After wheat and cotton the most important crop is the opium poppy. This is found in great variety and is only now being fully studied; a preliminary account of this is given. The Persian poppies have a smaller number of heads but are earlier than the Afghan varieties.

The gram (*Cicer arietinum*) is present in considerable variety; the Persian are again earlier than the Afghan types. Similarly with lentils, which are also more drought resistant. Reference is also made to a number of other legumes, most of which present less variation.

Of the oil plants discovered the chief were *Eruca sativa*, *Sesamum indicum* and *Ricinus*.

Beet, carrots and rape are found in considerable abundance and variation, in addition to a large number of other vegetables.

The types of tobacco (*Nicotiana rustica*) and *Cannabis sativa* and Saffron (*Crocus sativus* var. *Hausknechtii*) are discussed, followed by a brief treatment on similar lines of fruit trees, many of which are of high quality and productivity and merit further investigation. Of these the most important are the apricot and peach, which grow both wild and cultivated in great variety; also the walnut. The same is true to a less extent for *Zizyphus vulgaris*, *Eleagnus*, *Prunus*, fig, pomegranate, almond, pistachio, date palm, *Rubus*, grape.

201. BROEKEMA, C. and DUDOK VAN HEEL, J. 608.3:633
Protection des obtentions des sélectionneurs. (Protection of breeders' products.)
XV Congr. Internat. d'Agric. Prague. 1931.

202. CHRISTIANSEN-WENIGER, F. 631.524.4:633.11
Bedeutung der Landsorten für die Pflanzenzüchtung. (The importance of "land races" for plant breeding.)
Der Züchter 1931 : 3 : 321-23.

The types of "land races" of wheat found in expeditions in Central Europe are briefly described. These were very uniform for any one region, changing gradually from the lax, white awnless *vulgaris* types in the westerly districts to awned or brown types further east. The progeny of these displayed the greatest variation in all characters, indicating a great wealth and diversity of genes and extreme value for cross-breeding. One of the selections proved to be extraordinarily resistant to keen frosts and sudden temperature changes. To prevent the loss of such valuable genes it is urgently recommended that the "land races" of all countries be preserved.

203. GLEISBERG, W. 631.541.11
Die Kernobstunterlagenselektion in England. (Selection of stone fruit stocks in England.)
Der Züchter 1931 : 3 : 305-21.

A review.

PLANT PESTS 632

204. CRAIGIE, J. H. 632.452:577.8
An experimental investigation of sex in the rust fungi.
Phytopathology 1931 : 21 : 1001-40.

A historical review of the subject is given and the experimental methods described. The results are then described and illustrated of the experiments in which it was shewn that monosporidial inoculations, although they might produce pustules, never resulted in the formation of aecia ; that bisporidial inoculations sometimes did and sometimes did not produce aecia, thus proving that the fungus was heterothallic.

By transferring the nectar (containing pycnia) from a pustule of one strain to a pustule of the opposite strain, aecial formation was immediately started, the function of the pycnia as male organs being thus established. The agency of flies in mixing the nectar was demonstrated. The action of the nectar was destroyed by heat. By careful lateral application of nectar, pustules bearing aecia only at one side were produced.

As a result of mixing nectar in this way hitherto unknown physiological forms have arisen ; the work of other authors on hybridization of physiological forms is mentioned.

205. BAUCH, R. 632.521:577.8:575.113
Die genetischen Grundlagen der multipolaren Sexualität der Pilze. (The genetical basis of multipolarity for sex in fungi.)
Ber. deuts. Bot. Ges. 1931 : 49 : 72-75.

Some of the recent opinions on the subject are mentioned, in which it is shewn that one of the two factor pairs concerned in sexuality governs the conjugation and the other the further development of the product. The genes are therefore compared to the sterility or lethal genes in the higher plants. Experiments are described which seem to confirm this view.

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206. HEUSER, W. 633:575(43)
 V. Bericht über die Tätigkeit des Instituts für Pflanzenzüchtung 1930/31.
 (Report on the activity of the Plant Breeding Institute, 1930/31.)
 Landw. Jahrb. 1931 : 74 : 66-80.

A brief account of the breeding work at the Prussian Experiment and Research Institute in Landsberg (Warthe) is given.

Attempts are being made to select hardy types from hybrid populations of winter barley. From other hybrid populations attempts are being made to select types combining the strong root system, resistance to acid conditions, standing power and productivity of Hado barley with the earliness of the 4-rowed barleys.

Heterosis in rye was shewn to vary with the parental combinations and with the year.

Selections from hybrid populations of winter wheat have been continued and new inter-varietal and interspecific crosses made. The yields of hybrid populations have been compared with those of the parents to study the inheritance of the components of yield.

Inbreeding of potatoes for inheritance studies has been continued and crosses of contrasted individuals made. Studies of potato seeds are also in progress.

Breeding work with bilberries and varietal tests with a number of other crops are also in progress.

207. BOONSTRA, A. E. H. R. 633:575:581.1
 631.557
 Pflanzenzüchtung und Pflanzenphysiologie. (Plant breeding and plant physiology.)
 Der Züchter 1931 : 3 : 345-52.

The choice of parents is the most important step in breeding and the one which most influences the results. The lack of knowledge of the true nature of physiological phenomena determining yield and similar characters of practical importance is pointed out and regarded as one of the most serious handicaps to a successful choice of parents.

As examples of this, experiments are quoted in which the yields of different oat varieties were in the same order as the "length of life" of their leaves and not in the order of their leaf surface. In another experiment with peas the weight of the aerial portions compared with that of the roots was measured; increases in this ratio were accompanied by increases in the yield of seed. High values of these two were regularly associated with deep root systems. The variety which gave the highest values absorbed the greatest quantity of water and of ash constituents.

Experiments to test the amount contributed to the grain by the various leaves of the wheat plant have shewn that almost the whole of the carbohydrate in the grain is contributed by the glumes and is formed after the time of flowering.

The author emphasizes the fact that yield is made up of a number of components and that an understanding of these components and of the presence of different components in different varieties would give greatly enhanced possibilities for cross-breeding.

208. FEICHTINGER, E. K. 633:575:63.00.15(43.6)
 Die Entwicklung und die praktische Tätigkeit der Lehrkanzel für Pflanzenzüchtung an der Hochschule für Boden-kultur in Wien und der Pflanzenzuchtstation in Gross-Enzersdorf. (The development and activity of the faculty of plant breeding at the Hochschule für Bodenkultur in Vienna and the Plant Breeding Station at Gross-Enzersdorf.)
 Z. Züchtung 1931 : A. 17 : 1-7.

A brief account of Tschermak's work and the successful strains he has produced.

209. VAVILOV, N. I.

633:576.16(58)

(The role of Central Asia in the origin of cultivated plants.)

Bull. Appl. Bot. Genet. and Plant-Breed. 1931 : 26 : (3) 3-44.

A large number of plants such as rye, various legumes etc., which in Afghanistan and such regions are common, in Kashgar and the district under present investigation north of the Himalayas, were entirely absent, although the ecological conditions are entirely favourable to their growth.

Still more striking is the very small number of varieties and sub-species in central Asia of species such as *Triticum vulgare* in which Northern India, Afghanistan, etc., are extremely rich.

Moreover, the region exhibits an unusually large number of forms of various plants possessing recessive characters ; recessive forms in fact are said to predominate. Amongst these is a peculiarly early variety of *Sesamum indicum* which will possibly be valuable for cultivation in northerly situations, and races of cotton ripening earlier than almost any known variety and very drought resistant (*Gossypium herbaceum*).

Central Asia has no independent flora of its own, containing entirely recessive or imported types. The great wealth of forms characterizing the south-west foot of the Himalayas has apparently been kept off by the Himalayas themselves.

On the other hand soya beans and many other typical Chinese crops shew a much greater richness of forms and the rice varieties are also allied to the Chinese varieties. Poppies also shew great variety and prominence of dominant characters, suggesting that their centre of origin is in China, and hemp is found wild to such an extent as to indicate that from this region it may have entered into cultivation. The same applies to the wild apple, *Malus pumila*.

210. VAVILOV, N. I.

633:576.16(72)

(Mexico and Central America as the principal centre of origin of cultivated plants of New World.)

Bull. Appl. Bot. Genet. and Plant-Breed. 1931 : 26 (3) : 135-99.

The species which are common to the old and new worlds, since before Columbus' time, are comparatively few, e.g. *Gossypium*, *Solanum*, *Prunus*, *Vitis*. The new world was lacking in most of the ancient European and Asiatic crop plants. The vast majority of our cultivated plants have originated in the new world, in a comparatively restricted region and they are present in Central America to-day in great abundance and variety. The number of species of trees and shrubs in Mexico is ten times that in the whole of Russia and the Caucasus.

Even in Central America itself the species are concentrated towards the south and of the wild species known, 64 per cent of these belong to Southern Mexico. The same is true of cultivated species. Certain whole genera, as *Zea*, are endemic.

Of exceptional interest amongst the plants collected are species of potato, *Solanum Antipoviczii*, *S. demissum*, which are immune to *Phytophthora* and other diseases whilst fully fertile in crosses with the common potato—the latter is also frost resistant ; a variety of ecologically different forms of maize ; varieties of *Gossypium hirsutum* differing little from well-known cultivated forms, together with a large number of other species, some of them new, a great variety of Upland types, some of them possessing high yields of lint, others qualities of early maturity, etc. The same luxuriance was observed in a number of horticultural species, including a number of fruits which may be capable of introduction into the U.S.S.R. Emphasis is also laid upon the occurrence of relatively cold-resistant varieties of guayule.

Other centres evidently exist in South America, the Peruvian centre being almost as important as the Central American and Mexican centres. Some of the species which are common are yet distinct in the Peruvian centre and their individuality is frequently displayed on crossing.

The author expresses the opinion that the most ancient agricultures from which our cultivated plants have developed were of the rain-fed, non-irrigated type.

Central America is characteristic in that the wild forms as well as the cultivated are found in most cases and indeed there is frequently no clear dividing line between them.

The immense variety of ecological conditions is thought to be responsible for the variety of types occurring, together with the moist tropical mountain conditions.

211. LIELMANS, M. 633.1:575(47.43)
La Station de Sélection de Stende (Lettonie). (The selection station of Stende, Latvia.)

Bull. Assoc. Internat. Sélect. Plantes Grande Culture 1930 : 3 : 278-81.

The station is engaged in the work of selection in rye, wheat, barley, oats, peas, potatoes and flax. Artificial hybridization is being used more and more.

Varieties superior to local and foreign varieties in yield, standing power and hardness have resulted. Certain of such lines of spring wheat are also of high quality. One of the barley lines is said to be resistant to *Helminthosporium gramineum* and very early.

212. GASSNER, G. and RABIEN, H. 633.1-2.111:578.081
Ueber die Durchführung der Frosthärteprüfungen von Getreidezuchtstämmen. (The performance of winter-hardiness tests on cereal strains resulting from breeding.)

Der Züchter 1931 : 3 : 297-300.

The tests consist entirely of artificial freezing tests. All plants must be subjected to a period of growth under winter conditions before tests are made. Satisfactory tests cannot be made before the plants have reached the three leaf stage. Before the tests begin the plants are subjected to temperatures of 0° C. gradually falling over a period of three days to -5 to -6° C. The actual test lasts 24 hours at a temperature of -15° C., after which they are thawed gradually during two days at a temperature between 0 and 1° C.

Results are only comparative and various standard varieties must be used in every test.

The tests performed have shewn a very good agreement with the results obtained in the field.

213. 633.11
Din încercările făcute în câmpul de selecție al societății "Sămânța." (On experiments made on the selection ground of the society "Sămânța.")
Bul. Minist. Agric. Domeniilor 1931 : 3 : 194-98.

The strain of wheat No. 117 is compared with Bz 7 from which it has been selected. It has a higher yield and a better flour than Bz 7. It ripens a few days earlier, is less easily affected by soil and climate and is more drought resistant. Its resistance to lodging and rust is about the same as Bx 7.

214. YAMASAKI, M. and HATANO, S. 633.11:575:519.241.1
Ueber die Korrelationsverhältnisse bei den Weizen aus dem Standpunkte der Züchtung. (On correlations in wheat from the point of view of breeding.)
Jap. J. Genet. 1930 : 6 : 143-44.

The F_2 of a cross between a long-stemmed late heading wheat and a short-stemmed early heading strain shewed a clear positive correlation between stem length and heading. The cross between long-stemmed pubescent and short-stemmed non-pubescent wheats segregated as 3:1 in F_2 and it was found that the stem of the pubescent plants was on an average 4 cm. longer than that of the non-pubescent.

215. MADER, W. 633.11:575:664.641.016
Weizenqualität als Zucht- und Erzeugungsziel. (Wheat quality as an object of breeding and production.)
Der Züchter 1931 : 3 : 286-97.

Baking quality in general is discussed, followed by the imperfections of the experimental mills at present obtainable and the desirability of having the milling done at a central institution. The advantages and disadvantages of direct baking tests are discussed; also the fermenting power of the flour and its determination (although this is said to be of little importance to the breeder).

The author briefly describes the method of determining the content of moist and dry gluten, preliminary testing of its quality in the wet state, methods of determining the strength of the dough, including the new Hankóczy method which enables the consistency, its change during kneading, and the water-absorbing power of the dough to be automatically measured and an excellent agreement with the actual quality of the bread produced to be obtained rapidly and easily.

The method of Pelshenke of subjecting bruised grain to fermentation under water and measuring the increase of volume before it bursts, is described and discussed briefly. The method is said to be simple and reliable and is worthy of at least a trial.

It is pointed out that in most countries the only way to improve the quality without losing in yield, etc., is by cross-breeding, in which the choice of parents is of the utmost importance. Owing to the operation of polymeric factors large populations must be used and repeated back-crosses and crosses with other high quality wheats must be effected. The importance of exact measurements of the quantity and quality of the gluten of the hybrid material in the earliest possible stages (the second generation if possible) in conjunction with yield tests is emphasized. The various ways in which state control would aid plant breeding are considered.

216. STEWART, G. 633.11:575.116.1

Correlated inheritance in a cross between Dicklow x Sevier wheat.

J. Amer. Soc. Agron. 1931 : 23 : 916-28.

The coefficients of variability for various characters were taken for the F_3 progenies of the cross of two pure lines of the parental varieties. The coefficients were much higher for the heterozygous families than for the homozygous families or the parents in the case of density of ear, which was apparently governed by one factor, although a certain amount of transgression occurred; awn colour also appeared to be dependent on one factor, also awning.

No segregation could be observed for number of culms and the coefficients of variation were rather similar to those for the parents; similarly with the thickness of the neck, although greater variation was observed in the progenies than in the parents. Segregation occurred for height of plant, greatly increased variation being observed in F_3 and certain true-breeding dwarfs segregated.

The correlations between a number of characters were studied. Density and awn length was the only important positive correlation observed, amounting to $+ .7121 \pm .03141$ in homozygous progenies.

217. BLARINGHEM, L. 633.11:575.127

Sur la production expérimentale des blés épeautres (*Triticum Spelta* L.) à partir d'une plante sauvage (*Aegilops ventricosa* Tausch.) [On the experimental production of spelt wheats (*Triticum Spelta* L.) from a wild plant (*Aegilops ventricosa* Tausch.).]

C. R. Acad. Sci. Paris 1931 : 193 : 330-33.

A number of lines have been fixed from the hybrid (*Aegilops ventricosa* x *Triticum turgidum*) x *T. turgidum* made in 1925, which correspond in all characters to spelt wheat, *T. Spelta*. Three series have been separated, two of which correspond to accepted sections of *T. Spelta* L., the third to a new section, *T. Spelta* L. sect. *polycoccum* mihi. These latter have clear affinities with *T. vulgare*.

The parents are described from the point of view of density and other ear characters, followed by the hybrid lines.

The fertility increased very rapidly in succeeding generations. The extracted lines are as fertile and productive as cultivated wheats.

Certain clear *turgidum* characters are to be observed—the tough rachis and the free-shedding grains being of the most value. The grains are different from *turgidum*, *vulgare* or *Spelta*. The large number of fertile grains per spikelet (up to 5) in the new *Spelta* type is another valuable and unexpected character.

218. BLEIER, H. 633.11:575.127:576.356.7
 Neue Beobachtungen über die Reduktionsteilung von Weizen-Roggen- und *Aegilops*-Weizen-Bastarden. (New observations on the reduction division of wheat x rye and *Aegilops* x wheat hybrids.)
 Paper read at the 5th International Botanical Congress, Cambridge, 1930.

In a number of cases two spindles, or intermediate stages between one and two, were observed. In such cases the numbers of chromosomes in each spindle correspond with the respective parental chromosome numbers. This indicates that the whole nuclear apparatus must have remained distinct.

The longitudinal splitting of the bivalents and univalents occurs simultaneously and only after this do the univalents move to the pole, joining the gemini partners.

In discussing the formation of bivalents the author points out that this can depend upon a number of circumstances, one of which is the presence or absence of the genom with which the chromosomes in question have most affinity. In the case of its absence, the chromosome may pair autosyndetically with another chromosome with which it has less affinity. Even cases of pairing between members of the same genom are quoted.

The difficulty of accurately detecting autosyndesis and consequently of using it in determining homologies is discussed.

219. KATAYAMA, Y. 633.11:575.127:576.356.7
 Variation in number of chromosome conjugations in the F_1 hybrids between *Triticum durum* and *Aegilops ventricosa*.
 Bot. Mag. Tokyo 1931 : 45 : 424-45.

The hybrid is sterile. The diploid chromosome number is 28, the sum of the parental haploids. The number of bivalents varied from 0 to 4, usually 0. When bivalents did occur they were thought to be the result of autosyndesis between members of the 2 *Triticum* genomes. The number of bivalents seemed to be independent of external conditions except high temperatures, which reduced the number.

220. BUCHINGER, A. 633.11:575.127:633.14
 Ein Roggen-Weizen- und Weizen-Roggen- Bastard! (A rye-wheat and wheat-rye hybrid !)
 Der Züchter 1931 : 3 : 329-33.

In 1930 the author succeeded in producing the third recorded rye-wheat hybrid with common rye as the female parent and *Triticum vulgare* as the male. The varieties used flowered at the same time and four hybrid grains were obtained. By growing the hybrid plants with great care and special reference to the fact that their osmotic pressure is likely to be less than that of the parents—a point previously stressed by the author—they were brought to maturity.

In time of ripening the hybrids were more like the rye than the wheat parent. The gynaecium was well developed but the anthers did not burst. The rye character of hairy neck was clearly expressed and the hybrid seemed identical with the reciprocal ; the set of grain, however, was very much less.

The characters of the two parents and the reciprocal hybrids are tabulated. Hybrid vigour was displayed in certain characters. The grain formed is thought to be the result of out-pollination from one of the parents ; its germination was good.

221. BERG, K. H. v. 633.11*Aegilops*:575.127:633.14:576.356.7
 Autosyndese in *Aegilops triuncialis* L. x *Secale cereale* L. (Autosyndesis in
Aegilops triuncialis L. x *Secale cereale* L.)
 Z. Züchtung 1931 : A. 17 : 55-69.

The number of bivalents in the hybrid is never more than seven, usually five to six and sometimes less. There is a corresponding number of univalents, making a total of $2n = 21$. At anaphase the univalents split longitudinally and most of them form a metaphase plate. The further behaviour is briefly outlined, being in general agreement with the observations of Karpechenko and Sorokina, except that the univalents could be clearly recognized as belonging to two different size categories. The smaller ones were similar in type to the bivalents. The larger ones were never paired and their number always amounted to seven, the number of the smaller ones varying conversely with the number of bivalents. These were evidently the *Aegilops* chromosomes and this is taken as a proof that pairing is a result of autosyndesis between the two *Aegilops* sets. The difference in size is thought to result from a different reaction of the chromosome colloids to the hybrid medium.

The author points out that the autosyndesis is not to be regarded in any way but as exceptional, a result of exceptional conditions, and explains the possible danger of using such phenomena as arguments for homology.

222. MICZYNSKI, K. 633.11*Aegilops*:575.127.2
 Studja genetyczne nad rodzajem *Aegilops*. II. Morfologia i cytologia
 mieszańców międzygatunkowych. (Genetic studies in the genus
Aegilops. II. The morphology and cytology of the interspecific hybrids.)
 Bull. Acad. Polon. Sci. Lettres 1931 : 51-83.

In the cross *Ae. ovata* x *Ae. speltoides* the type of the former was dominant to the latter in respect of a number of characters and the hybrid was intermediate in respect of a number of others ; the *speltoides* type was dominant for two characters only.

One grain was formed in seventeen ears isolated in the greenhouse ; thus the grain was probably the result of self-fertilization. One F_2 plant was thus produced, in many characters similar to *Ae. speltoides* but completely sterile. The pollen of both F_1 and F_2 was chiefly composed of empty grains, indicating a very irregular meiosis.

Hybrids of *Ae. ovata* x *Ae. ventricosa* are also described. One parental species preponderated in certain characters, the other in others, some characters again being intermediate. The hybrid was entirely sterile.

The same was true for *Ae. triuncialis* x *Ae. ventricosa*, *Ae. triuncialis* x *Ae. crassa*. The dominance relations of certain characters were not the same in all crosses. The chromosome numbers of the parental species were determined and agree with those reported by earlier workers.

The numbers of bivalents and univalents in the heterotypic division of the tetraploid hybrids are given. In *Ae. ovata* x *Ae. ventricosa* the averages of these were 4.9 and 18 respectively, the number of bivalents varying from 1 to 11. The behaviour of these elements is described ; in certain cases a tripolar spindle was observed. The homotypic division was also irregular.

In the *Ae. triuncialis* x *Ae. ventricosa* hybrid the number of bivalents in the heterotypic division varied from 6 to 11, with an average of 8.9 ; trivalents are also more numerous than in the preceding hybrid ; the homotypic division was rather more regular.

The pentaploid hybrid *Ae. triuncialis* x *Ae. crassa* had 3-10 bivalents and 29-15 scattered univalents. Curved spindles were sometimes observed and the homotypic division was irregular. The author concludes that the degree of affinity between the different *Aegilops* species is less than that which exists between the *Triticum* species.

The author agrees with Percival and Sax that the constant appearance of 6-7 parasyndetic bivalents in hybrids of *Ae. cylindrica* with *T. vulgare* indicates a true homology of one of the chromosome sets. It is pointed out that the chromosome pairing in interspecific *Aegilops* crosses is variable and frequently telosyndetic.

The further interrelations of the various species are discussed. The author deduces that *Ae. cylindrica* should have one set homologous with *Ae. triuncialis* and another with *Ae. ventricosa* and remarks upon the consequent interest which a study of crosses of these two latter species with *T. vulgare* would present.

223. TAYLOR, J. W. and LEIGHTY, C. E. 633.11:575.129:581.46
Inheritance in a "constant" hybrid between *Aegilops ovata* and *Triticum dicoccum*.
 J. Agric. Res. 1931 : 43 : 661-79.

Aegilops ovata was crossed with *Triticum dicoccum* and the progeny selfed through a number of successive generations. A study was made of a number of morphological and quantitative characters in the hybrids. There was little difference between the reciprocal F_1 hybrids, although the cross with *Aegilops* as the female parent gave more grains. In some characters they resembled the one and in others the other parent, being intermediate in others.

The seven F_2 plants obtained resembled the F_1 nearly entirely but in F_3 phenotypic differences were observed and plants representing the extremes of variation were grown into F_4 . A newly made F_1 was compared with these F_4 plants and significant differences were observed in respect of a number of characters. However, the differences in the following generation (F_2 and F_3) were much less marked. Quite clear differences were evident between different F_5 families arising from the selected F_4 plants and for some characters clear-cut segregations were observed in certain families. Completely sterile plants were observed in all families.

When crossed back on to *Aegilops* the F_1 hybrid gave 23 per cent seed and the F_4 hybrid 30 per cent. Somewhat similar results were obtained by pollinating the hybrids with *T. dicoccum* and *T. vulgare*; the reciprocal crosses were much less effective.

No entirely true-breeding, fully fertile strain behaving as a fixed species has yet been isolated.

224. SCHIEMANN, E. 633.11:576.16
 Pfahlbauweizen—Historisches und Phylogenetisches. (The wheat of the Lake Dwellings—historical and phylogenetical.)
 Z. Züchtung 1931 : A. 17 : 36-54.

The authoress considers the question of the origin of the various wheat groups from the pre-historical point of view. The oldest specimens of cultivated wheats found in the rocks are certainly of the emmer type; these are from Egypt. The cultivation of emmer has gradually been replaced by the naked wheats.

The types found in the Swiss lake dwellings correspond very closely to those found in Egypt, Abyssinia and Babylonia. Emmer has been found in the intervening tracts, either in the rocks or in cultivation in isolated regions. Each of the latter represents a distinct local type but the types of neighbouring localities are closely related. It seems that at a very early time the cultivation of emmer was continuous in this region, having spread from Abyssinia, which on Vavilov's theory is its centre of origin; it is thought that emmer evolved from the wild type simultaneously with the evolution of the people of these lands.

The intermediate region to-day is characterized by the presence of *Triticum dicoccoides* and *T. aegilopoides* together and it is thought not improbable that the former has arisen from the latter by chromosome doubling, the latter having passed westwards and given rise to *T. monococcum* and the former eastwards giving rise to *T. dicoccum*. The peculiar physical conditions of Abyssinia are thought to have arrested the migration and brought about that multiplicity of variation pointed out by Vavilov. A similar course of events is envisaged for the hexaploid wheats in the highlands of Iran. The forms most frequently found in the rocks are *compactums* and this is the form in which the hexaploid wheats are thought to have entered Europe from Asia.

The presence of this with *dicoccum* is taken to indicate that the latter has also entered Europe from the east and that the two centres have been intimately connected in the past, the emmer entering Europe not direct from its centre but through the *vulgare* centre. The *compactum* being dominant to the ordinary *vulgare* it is regarded by the authoress as the primitive form, which accounts for its universal presence in the rocks. From these the ancient "land races" have been evolved and the authoress lays emphasis on the value of these in quality and local adaptability and in particular as material for breeding.

T. Spelta apparently originated after the stone age in the Rhine valley, from the emmers or the *vulgares* (or both by hybridization) which populated the country at the time of the stone age.

225. PLOTNIKOWA, T. W. 633.11:576.354.46:537.531
Einfluss der Röntgenstrahlen auf die Reduktionsteilung von Weizen. (The influence of X-rays on the reduction division in wheat.)
Z. Züchtung 1931 : A 16 : 662-68.

The investigations were carried out on the same material which Delaunay used previously for genetical examination. A number of irregularities of chromosome behaviour at meiosis are described, which would be expected to lead to irregularities in the progeny such as have been observed by earlier writers.

226. MASLOVA, K. S. 633.11:581.46.061.6
(Variation of the ear colour in wheat according to the geographical experiments of 1923-1927).
Bull. Appl. Bot. Genet. and Plant-Breed. 1930 : 24 (2) : 19-42.

The distribution of the pigment in the different wheat groups is discussed. The pigment is more intense in the margins of the glumes in the soft wheats but tends not to be so in the hard wheats with the exception of the Abyssinian forms. There also exists a large group of the so-called white-eared forms which are also capable of developing a slight red pigment in this marginal region.

Geographically it was found that in the case of the red-eared forms the most intensely coloured tended to occur towards the north and north-west, whilst in the case of black-eared wheats the reverse tendency was evident, as also in the case of the yellow pigment in "white" forms. The awns entirely lose their colour in northerly regions. The effect of high mountains is identical with that of more northerly position. On this basis the U.S.S.R. are divided into three regions, red-eared forms being almost universal but black more limited in distribution.

When different types are sown together under identical conditions clear differences are seen in the progeny, and types from different localities which appear the same may prove to be different in their progenies. The use of this in classification is advocated.

The influence of various external factors on the development of pigment was studied.

227. SĂULESCU, N. 633.11-2.111-1.521.6:575
Die Winterfestigkeit einiger F_1 -Winterweizenbastarde. (The winter hardiness of certain F_1 winter wheat hybrids.)
Der Züchter 1931 : 3 : 300-02.

The resistance of a number of varieties and hybrids was judged in the uncommonly low temperatures which prevailed in February 1929. The F_1 of certain crosses of highly resistant with highly susceptible varieties was intermediate; hardiness was "prevalent" in other crosses and in others dominant. The behaviour of the F_1 's was the same whether the resistant variety was used as the male or female parent. The F_1 of two susceptible varieties was highly susceptible. The author concludes that hardiness is governed by polymeric factors.

228. ALLEN, R. F. 633.11-2.452P. *trititina*:577.8
Heterothallism in *Puccinia trititina*.
 Science 1931 : 74 : 462-63.

A brief account of work by Craigie and others. The author has demonstrated similar sex phenomena in *P. trititina*.

229. GOULDEN, C. H. and NEATBY, K. W. 633.11-2.452-1.521.6:575
Breeding rust-resistant varieties of spring wheat.
 J. Amer. Soc. Agron. 1931 : 23 : 859-70.

This paper deals with the so-called "mature plant resistance" characteristic of H-44-24 and Hope, which apparently involves resistance to all physiological forms. It is shown that such resistance is independent of the seedling reaction, some of the varieties possessing it being completely susceptible in the seedling stage. Such resistance has been shown to be variously dependent on one or two factors or two factors and an inhibitor.

Considerable differences in resistance, judged by the method of the analysis of variance, are noted within hybrid strains from various crosses involving these resistant varieties. Similar analyses of yield show that the hybrid strains are superior to standard varieties and in quality they were equal to Marquis.

230. MANGELS, C. E. and STOA, T. E. 633.11:664.641.016
Evaluating new wheat varieties by the use of the baking test.
 Cereal Chem. 1931 : 8 : 381-91.

The baking test and its interpretation are discussed and loaf volume, among other things, as an indication of baking quality is brought into question. A low variation in volume as a result of varied lengths of fermentation is regarded as more desirable than a high volume obtained only under optimum conditions. Type of loaf is also regarded as primarily important.

231. ÅKERMAN, Å. 633.11:664.641.016:575
Weizenzüchtung auf Kornqualität. (Wheat breeding for grain quality.)
 Z. Züchtung 1931 : A 16 : 532-36.

As a result of the breeding of previous years the yield and also the standing capacity, disease and cold resistance of West European wheats has been enormously increased. The quality on the other hand has almost universally suffered, although the larger proportion of locally grown wheat necessitates an improvement in quality.

The question of baking quality in general is discussed and emphasis laid on the importance of the nature as well as the quantity of gluten.

Reference is made to the establishment of the fact that quality is hereditary and cases of the combination by hybridization of quality with productivity and other desirable characteristics are cited. The case of Svea II wheat in Sweden is taken as one of the examples.

Certain of the difficulties in breeding for quality are mentioned, e.g., the fact that quality is so often combined with a number of undesirable features and the wide differences which are found between the wheats with high quality and high yield, leading to difficulties in the later generations. More certain improvement can be obtained by crossing types as nearly as possible allied. It is not thought likely that good winter-hardy varieties will emerge from crosses of winter and summer types, although this may be a useful way of improving the yield of summer wheats.

At Svalöf the selection in the F_2 is done entirely on the texture of the grain. In the case of nearly related parents line tests are begun in F_3 , texture being also again taken into consideration and sometimes nitrogen determinations. Protein tests form the basis of F_4 selections and

determinations of gluten quality by the method of Berliner and Koopman or Peishenke. Very few lines remain in F_6 and baking tests are carried out with these. Selection for vitreous grains is again carried out on the best lines.

With widely differing parents the line selection is begun only in F_6 — F_{10} . A very rigorous selection is performed in F_2 and the grain bulked and multiplied for four to eight years as a "population," after which a new line separation is begun. Selection for quality then follows as above. Baking tests of various kinds and on crops grown in different localities and different years are carried out before a new variety is put on the market.

The author points out the desirability of having as accurate methods as possible for the determination of quality in small quantities of grain and of having these methods uniform for all workers and if possible for all workers to use a common standard variety.

232. FLORELL, V. H. 633.13:575.11:575.127.2
Inheritance of type of floret separation and other characters in inter-specific crosses in oats.
 J. Agric. Res. 1931 : 43 : 365-86.

A. fatua and varieties of *A. sterilis*, *A. sativa* and *A. byzantina* were used as parents. The inheritance of the types of rachilla attachment, the separation of the second floret and the species-type characters associated with it were studied in all crosses and the inheritance of hairiness of the lemmas and of the culm node and colour of the grain in some crosses. The non-articulate type of floret separation was dominant in a single factor inheritance in all but the cross *A. fatua* x *A. byzantina* var. Coastblack in which the numbers indicated a two factor inheritance. There was a one factor inheritance of awns and a complete linkage between the factor for strongly geniculate and twisted awns and the factor for spikelet separation by abscission except in the cross *A. fatua* x *A. byzantina* var. Fulghum in which crossing-over occurred. One factor inheritance was found for pubescent upper nodes, colour of lemma and hairiness of lemma ; in the cross *A. sativa* var. Richland x *A. sterilis macrocarpa* an inhibitor of the latter character is indicated.

Sterilis plants occurred in the F_2 of the cross *A. byzantina* var. Coastblack x *A. fatua* and are assumed to be due to the interaction of two factors for floret separation to which are linked the strongly geniculate and twisted awns and certain other characteristics of *A. sterilis*.

Type of floret separation and pubescence of the lemma segregated independently in the cross *A. fatua* x *A. sterilis ludoviciana*. There was complete linkage between geniculate and twisted awns and the wild type articulate spikelet in all crosses except *A. fatua* x *A. byzantina* var. Fulghum. There was also complete linkage between spikelet separation by abscission and hairiness of the callus. Pubescence of the lemma and colour of the lemma were almost completely linked in *A. fatua* x *A. sterilis ludoviciana*.

233. NISHIYAMA, I. 633.13:575.242
 633.13:575.242:576.312.36
The genetics and cytology of certain cereals. II. Karyo-genetic studies of fatuoid oats with special reference to their origin.
 Jap. J. Genet. 1931 : 7 : 49-102.

From each of three heterozygous fatuoids three generations were grown. The normal plants and the homozygous fatuoids produced were sown on and bred true. The proportions of these two types and the heterozygous fatuoids confirmed the relation 1 : 2 : 1.

The fatuoids of the first strain had 21 bivalent chromosomes ; unpaired chromosomes were observed but only rarely. One plant out of twelve normals had 41 chromosomes only and one 41 chromosome plant amongst the heterozygous fatuoids was found. No definite relationship could be observed between the behaviour of the parents and their progeny with respect to unpaired chromosomes and no significant difference was observed in the behaviour of the three types.

The fatuoids of the second group behaved somewhat similarly, but in addition to univalents, chromosome complexes were occasionally observed. Two normals had complexes of four elements; the progeny of one of these shewed a diploid number of 41, the progeny of the other shewed no abnormality. Similar irregularities were observed in some of the heterozygous and homozygous fatuoids, and in almost the same frequency.

The third group was similar again and it is concluded that the chromosome irregularities are independent of the phenotypic character of the grain.

The progeny of a heterozygous fatuoid thought to have a diploid number = 41 is described. The progeny consisted nearly entirely of heterozygous and homozygous fatuoids and only very few normals appeared. The fertility of the heterozygotes was low and very variable, whilst the homozygotes (dwarfs) were completely sterile. The normals exhibited the normal chromosome condition, only occasionally shewing two bivalents; the condition in the heterozygotes was usually $20\text{II} + 2\text{I}$ but the number of univalents was very variable; meiosis in the dwarf homozygotes was extremely irregular, $0 - 10\text{II}$ being observed only and the total chromosome number being 40. Three types of meiotic division frequently observed in the latter are described.

Another group of homozygous fatuoids was observed, characterized by partial fertility and 41 chromosomes, which divided in a way similar to the heterozygotes. The univalent in this case is thought to be a fragment carrying the fatuoid genes.

By examining the tetrads of heterozygotes the proportions of 20 and 21 chromosome gametes were calculated and from this the proportion of 40, 41 and 42 chromosome zygotes. Assuming that the observed sterility in heterozygotes results entirely from the death of the 40 chromosome zygotes the proportions of resulting zygotes with 40, 41 and 42 are calculated and fit very closely the observed proportions.

The author questions the chromosome aberration theory as applied to the first series of fatuoids. He regards these as having resulted from mutation in the c chromosome. The occasional meiotic irregularities are ascribed to the lack of complete harmony between the chromosome sets, possibly indicating a hybrid origin of the oats in which they first occurred, or possibly only the result of the polyploid nature of the species. The second series is regarded as arising from chromosome aberration and it is suggested that the c chromosome bears a factor which influences the conjugation between homologous chromosomes.

234. NISHIYAMA, I. 633.13:575.242:576.312.35
Fatuoidhafer und Chromosomenzahl. (Fatuoid oats and chromosome number.)
Jap. J. Genet. 1930 : 6 : 186-87.

A strain of oats segregated into fatuoid 230 : heterozygous 376 : normal 25, with 40, 41 and 42 2n chromosomes respectively. The heterozygous plants produce two kinds of gametes with 20 and 21 chromosomes in the proportion 6.22 : 1 which by free combination would give individuals with 40, 41 and 42 chromosomes about 39 : 12 : 1 and, as many of the 40 chromosome individuals die in the early stages, the segregation ratios are explained.

235. BERG, V. 633.14:575
Züchtung des Sagnitzer Roggens 1930-31. (Breeding Sagnitzer rye 1930-31.)
Z. Züchtung, 1931 : A 16 : 657-61.

A number of lines were subjected to obligatory self-fertilization. The success was very different in the different lines. The grains which under free conditions originated by self-fertilization were also separated out, being recognized by the remains of the stamens on the tip; these grains were propagated, cross-fertilized grains being rejected. As a result of these methods 498 lines with 2088 free self-fertilized grains have been obtained this year.

Selection of ordinary cross-fertilized rye has also been in progress, with ear weight, 1000 corn weight and uniformity of the various ears as basis. The lines with the best ears are selected with the object of building up a valuable strain. They are also used for interplanting in the selection plots as pollinators.

236. BLEIER, H. 633.14:575.127
 Ueber Vererbung von Gattungsbastarden des Roggens (*Aegilops*-Roggen und *Aegilops*-Roggen-Weizenbastarde). [Inheritance of genus hybrids of rye (*Aegilops* x rye and *Aegilops* x rye x wheat hybrids).]
 Z. Züchtung 1931 : A. 17 : 70-79.

The first case of partially fertile *Aegilops* x rye hybrids is reported. The parents were *A. ovata* x *Secale cereale*; four hybrid grains were obtained and three germinated and gave mature plants which flowered. All three were identical, possessing many rye characters and a certain number of *Aegilops* characters. The plants were characterized by a relatively rather high fertility and 104 grains germinated.

The F_2 plants all greatly resembled the F_1 in all but a few characters but the fertility was much lower. Very clear segregation occurred however in F_3 , one plant being of a clear squarehead type and is thought to be the product of natural crossing with *Triticum vulgare* pollen. A certain number of F_4 and F_5 plants were obtained.

237. ROEMER, T. 633.14:581.162.3
 Ueber die Reichweite des Pollens beim Roggen. (The range of rye pollen).
 Z. Züchtung 1931 : A. 17 : 14-35.

Two varieties of rye were chosen, such that cross-pollination could be easily detected by dominant colour factors which appeared in the grain and the coleoptiles of the seedlings. The varieties were sown at different spacings, the experiments covering a period of four years. The amount of cross-pollination decreased with the distance between the varieties. Considerable protection against out-pollination could be effected by interposing linen cloths between the two varieties. Out-pollination was observed in particularly late flowering or self-sterile plants at a distance as great as 600 m. The amount of foreign pollen is very much dependent upon the direction of the wind.

The author concludes that beds of plants for breeding should be grown at a distance of not less than 30 m. apart and the marginal plants rejected at the time of harvest, if out-pollination is to be avoided.

238. KOESLAG, J. D. 633.14-2.223-1.521.6:575
 Een onderzoek over de resistentie van verschillende roggerassen tegen het stengelaaltje. (An investigation on the resistance of various races of rye to the nematode.)
 Tijdschr. Plantenziekt. 1931 : 37 : 96-104.

A number of varieties and selections were tested in infected ground. The majority of varieties, including Petkus, were susceptible, only two West European land races displayed a certain degree of resistance.

Attempts are being undertaken to improve the cultural value of the races whilst preserving their resistance. One of the methods under trial is to interpollinate two resistant plants.

The difficulty of the problem is pointed out; it will first be necessary to determine whether the resistance falls on inbreeding.

239. 633.15:575
 Corn breeding proves costly for the individual grower.
 Off. Rec. 1931 : 10 : p. 288.

It is pointed out that it is more profitable as a rule for the grower to obtain high-bred strains from the experiment stations than to do his own breeding.

240. TAVČAR, A. 633.15:575.11:581.143.32
 Einige neue Kreuzungsprodukte decussierter Maispflanzen. (Some new products of hybridization of decussate maize plants.)
 Der Züchter 1931 : 3 : 333-38.

Plants with decussate leaves were first observed in the F_2 of two normal plants. In their selfed progeny a number of decussate plants again appeared, together with two new types—one type with a very much branched aerial portion, the other bearing a side axis partly composed of female and partly male flowers. Four of the decussate plants developed no cob.

The progeny of backcrossing contained decussate, brachitic, dwarf plants, plants of which one half was decussate and plants of the above two abnormal types.

In the progeny of selfing and intercrossing these plants, a further abnormal type appeared, with leaves in whorls of three. The results are tabulated and the new types described.

So far it has not been possible to produce a homozygous decussate plant, only an increase in the number of decussates in the progeny, indicating the action of a number of factors. The abnormal flowering axis is monofactorial and is given the symbol $Ps\ ps$.

241. BRINK, R. A. and SENN, P. H. 633.15:575.116.1:575.242.061.1
 Heritable characters in maize. XL. Ragged, a dominant character, linked with a_1 , ts_4 and d_1 .
 J. Hered. 1931 : 22 : 155-61.

Tattered leaves at maturity characterized the mutation described as "ragged" and were due to a single dominant gene Rg .

Backcrosses revealed linkage with 11.9 per cent crossing over with the dwarf character d_1 and there is evidence (some unpublished) that in the group is a_1 — ba_1 — Rg — d_1 — cr and also na , ts_4 and pg_2 but with a doubt as to their position.

242. EYSTER, W. H. 633.15:575.116.4:581.48
 Heritable characters of maize. XLII. Reduced endosperm.
 J. Hered. 1931 : 22 : 251-52.

One gene for reduced endosperm is shewn to be a simple recessive, to be located in chromosome VIII near the gene Vp_2 . A second reduced endosperm gene, Re_2 , also a simple recessive, is shewn to exist in the same chromosome, still nearer to Vp_2 .

243. EYSTER, W. H. 633.15:575.116.4.061.6:581.48
 Heritable characters of maize. XLI. Dilute aleurone.
 J. Hered. 1931 : 22 : p. 255.

Dilute aleurone colour seems to be dependent on a factor linked with *aurca* in chromosome 1.

244. EYSTER, W. H. 633.15:575.116.4:581.142
 Vivipary in maize.
 Genetics 1931 : 16 : 574-90.

A character consisting of the immediate development of seeds in the cob into seedlings, without intervention of a period of dormancy—thus vivipary—is described.

Four recessive genes for vivipary have been detected. The simple ratios in populations segregating for one of these could be completely masked by dry conditions which induced dormancy in viviparous plants or moist conditions which caused normal grains to germinate.

The first gene, Vp_1 was closely linked with R for aleurone colour in the second linkage group and also shewed linkage with G in the same group; it was inherited independently of the characters tested from other linkage groups.

Vp_2 was shewn to be linked with Pr for purple aleurone in linkage group VIII, also with various endosperm genes in the same linkage group and independently of characters in other groups. Certain other linkage relations of the genes involved are established, in which certain genes severally linked with Vp_2 are shewn to be linked with each other. Vp_1 and Vp_2 are inherited independently.

Vp_3 was linked with Su—sugary endosperm—in chromosome III and Vp_4 with Sh—shrunk endosperm—in chromosome I.

The author regards vivipary as a general phenomenon in the plant kingdom which is only retained, however, by particular types for which it has a survival value.

245. BRINK, R. A. and COOPER, D. C.

633.15:575.116.7:581.162.5

633.15:581.162.5:576.356.1

The association of semisterile-1 in maize with two linkage groups.

Genetics 1931 : 16 : 595-628.

Three genes for semisterility exist, the present study being mainly concerned with semisterile-1. When selfed or crossed with normals, semisterile plants give normal and semisterile in equal numbers. When these extracted normals are crossed with true normals, however, all semisterile result.

Semisterile plants are characterized by the presence of four chromosomes grouped together in a ring. Semisterility seemed to be independent of 1g but very clearly linked with V_4 in the same chromosome and to a less extent with Sk. It is concluded that the change in the chromosome which brings about semisterility involves that end of the chromosome at which these two genes lie, remote from 1g.

Linkage was very close also with br and f of the P-br-f group and it appears that this chromosome is also affected by the change which brings about semisterility; the section involved seems to be that near f, on the side remote from br. Linkage has also been demonstrated with other genes of this chromosome.

Semisterility proved to be inherited independently of the remaining seven linkage groups. Linkage was indicated with brown midrib, bm_2 , whose linkage relations are unknown, indicating that this gene is in one or other of the two chromosomes concerned with semisterility.

It is shewn that almost exactly one half of the spores, both male and female, produced by semisterile plants carry the sterility complex, although factors other than chance apparently influence the frequency distribution of the two types.

It seems probable that a segmental interchange has taken place between the ends of the P-br and the 1g- v_4 chromosomes in the vicinities of the a_1 and v_4 genes respectively. By the mutual attraction of the homologous ends the formation of a ring is explained. According to the arrangement of the constituents of the ring on the spindle, daughter nuclei will be formed with or without the full complement of hereditary material, the latter of which give sterile gametes. The various cases are illustrated. The arrangement is evidently random, as seen by the results and by a cytological examination of the ring plants.

The presence of semisterility seems to have no effect on the crossing-over percentages and therefore the assumptions made as to the position of the interchange are probably correct.

The normal plants transmitting semisterility are evidently the homozygotes for the double translocation; these plants appear to be normal in every way. Male gametophytes carrying the semisterile complex also seem to develop as well as normal gametophytes.

246. MAINS, E. B.

633.15-2.452-1.521.6:575

Inheritance of resistance to rust, *Puccinia sorghi*, in maize.

J. Agric. Res. 1931 : 43 : 419-30.

Lines homozygous to the form of rust used have been isolated by inbreeding. Different lines have been found to be resistant to different physiological forms of the rust.

In crosses between resistant and susceptible lines all the F_1 plants were resistant to physiologic form 1; F_2 and backcross results indicated a monofactorial inheritance. Similar results were obtained with respect to physiologic form 3, resistance to both forms being evidently dependent on the same factor.

No evidence of linkage was obtained with a number of other characters examined.

Similar behaviour occurred with another group of resistant lines, except that these were resistant to only one of the two rust forms used. This indicates that the resistance factor is distinct.

247. DAVID, P. A. 633.16:575.11

A study of crosses between Trebi and three smooth-awned varieties of barley.

J. Sci. Iowa St. Coll. 1931 : 5 : 285-314.

The rough-awned, six-rowed barley Trebi was used as the male parent and the smooth-awned, six-rowed barleys, Comfort, Glabron and Velvet as the female parents in the investigation.

The F_2 data indicated a one factor inheritance for roughness of awns but analysis of F_3 shewed that two factors were present, one dominant for smooth awns and the other a dominant inhibitor. The data of other investigators is analysed from this point of view and is found to be in agreement with the hypothesis of one or two inhibiting factors.

Earliness was found to be dominant to lateness and due to two complementary factors.

The F_1 's were all taller than their male parent and nearly as tall as their female parents. F_2 was very variable and both parent forms were recovered in F_2 and F_3 .

The evidence for the presence of genetical factors influencing the number of culms was slight as this character is easily affected by the environment.

Length of spike appeared to be dominant and the variability of F_2 and F_3 indicated segregation. There was little indication of segregation for yield. Correlation between yield and other quantitative characters was studied as well as parent-progeny correlations.

248. LUNDEN, A. P. 633.16:575.11

633.16:575.116.1

Arvelighetsundersøkelser i bygg. Nedarvning av bukstilkbehåring, snerpets beskaffenhet, internodiellengde, samt undersøkelser over disse karakterers innbyrdes korrelasjonsforhold. (Inheritance studies in barley. The inheritance of rachilla hairs, awn texture and density together with the investigation of the linkage of these characters.)

Meld. Norg. LandbrHøisk. 1931 : 11 : 143-68.

The crosses Asplund x DS 295 and Holleby x Smooth Awn II-21-27 were used. All are six-rowed. Asplund and Holleby are rough-awned with short rachilla hairs, D.S. 295 and Smooth Awn II-21-27 are smooth awned with long rachilla hairs. Asplund has short internodes and belongs to the group of pyramidal barleys, (*H. pyramidatum*, Kcke.), the others all belong to *H. tetrastrichum*.

Length of the rachilla hairs and rough v. smooth awns shewed monofactorial segregation in F_2 and F_3 with long rachilla hairs and rough awns dominant. Ear density was found to be due to two factors Aa and Aa in the cross Asplund x D.S. 295. There was no correlation between ear density and straw length in this cross.

Linkage between rachilla hair-length and smooth or rough awns gave a crossing over of 26.5 per cent for F_2 and F_3 plants but 29.4 per cent was found for the F_1 plants in F_3 and this number is taken as the most accurate. No correlation was found between either rough or smooth awns and ear density or rachilla hair-length and density.

249. HEY, A. 633.16-2.452:576.16
Beiträge zur Spezialisierung des Gerstenzwergrostes, *Puccinia simplex* Erikss. et Henn. (Notes on the specialization of barley leaf rust, *Puccinia simplex* Erikss. and Henn.)

Arb. Biol. Reich. Land. Forstw. 1931 : 19 : 227-61.

A full study of the conditions of infection and the existence of physiological races. Cultures were obtained from seventeen different localities and the existence of eight physiological forms was demonstrated. Of these only four were at all widely distributed.

The majority of varieties of both the *distichum* and the *polystichum* groups were susceptible. In the latter group certain varieties were found which were resistant to a number of forms, especially the forms prevalent in Germany. The two-rowed barleys tend to be resistant to the group of forms not prevalent in Germany.

Certain of the varieties tested segregated for resistance.

Some barleys were more resistant at low, others at high temperatures. A certain number were resistant at all temperatures.

250. GOKHALE, V. G., BHOSKAR, V. L. and PATWARDHAN, S. K. 633.17
Improvement of Nagli (*Eleusine coracana*) in the Bombay Deccan.
Poona Agric. Coll. Mag. 1931 : 23 : 78-91.

Contains a description of the flower, fruit and seed.

251. FUKU, Y. 633.18"793":581.035
On the short day and illumination treatment in rice, referring specially to the time and duration of treatment.

J. Imp. Agric. Expt. Sta. 1931 : 1 : 263-86.

Rice plants given short day illumination (8 a.m. to 4 p.m.) headed earlier than usual and in general the process was accelerated the earlier the treatment was applied.

252. CHIAPPELLI, R. 633.18:581.162.32
Ibridi naturali al campo sperimentale. (Natural hybrids in the experimental ground.)
Giorn. Riscolt. 1931 : 21 : 157-61.

Lady Wright and Chinese Ostiglia have almost the same flowering period and a natural hybrid was obtained between them. The caryopsis of this hybrid was awned and intermediate in size between the parents. Among the F_2 several valuable forms appeared with very large and transparent grains. These are being further cultivated.

253. * IWATSUKI, S. 633.18:581.48
Some experiments on the fertility of paddy rice.
Proc. Crop Sci. Soc. Japan 1931 : 3 : 10-21.

A study is made of the ripening of rice, which is shewn to be progressive from the tip downwards. The highest fertility is associated with the types which bear their grains singly rather than in clusters.

Heavy applications of fertilizers resulted in reduced fertility.

254. † FUKUCHI, T. 633.18-2.111
The resistance of rice plants to low temperatures and cool water in regard to its fertility.
Proc. Crop Sci. Soc. Japan 1931 : 3 : 3-9.

The tests shewed that seven of the varieties tested were resistant to low atmospheric temperatures and temperature of the water.

* A full summary of this paper is on file at the Bureau.

† A Full Translation of this paper is on file at the Bureau.

255. NAGAI, I. and IMAMURA, A. 633.18-2.8-1.521.6:581.44
Morphology of the "neck" of the panicle as related to the resistance against blast disease in rice varieties.
 Ann. Agric. Expt. Sta., Gov.-Gen. Chosen (Corea) 1931 : 5 : 289-304.
 The greater the number of stomata on the neck of the panicle the more susceptible the Japanese variety but this did not hold for foreign varieties.
256. MUNERATI, O. 633.41:581.143.26:575
 L'eredità della tendenza alla annualità nella comune barbabietola coltivata.
 (The inheritance of the annual tendency in the common cultivated beet.)
 Z. Züchtung 1931 : A. 17 : 84-89.
 Strains of beets, cultivated for many years, and constant annuals or biennials were crossed reciprocally. The F_1 were practically all annuals. The F_2 segregated into annuals and biennials in a monohybrid ratio. When grown with the parents, the hybrid annual was always later than the annual parent.
257. * CHARETSCHKO-SAWITZKAJA, E. 633.41:581.162.3
 633.41:575.12:581.08
 (Method and technique of artificial hybridization in beet.)
 Naukovi Zapiski 1931 : 13 : 613-32.
 The failures in the past in hybridizing beet are ascribed to the lack of knowledge of the biology of flowering and pollination and to some actual misconceptions—e.g., the idea that the flower is proterandrous; and to the sensitivity of the pollen to external conditions. It was therefore deemed necessary to make a study of these conditions, the report of which is given here in some detail.
 The merits and demerits of various methods of crossing are discussed.
 The biology of the gynaeceum and the pollen grains was studied, the times at which they reach their maximum activity and the period over which this is retained. The pollen was extremely sensitive to moisture and temperature and could be retained in a viable condition for up to 50 days at 0-2°C. and 5 per cent atmospheric moisture.
 The technique of emasculation and hybridization is described and illustrated.
258. YASUDA, S. and KITAMURA, T. 633.491:575.182
 A metaxenia-like phenomenon found in some plants of *Solanaceae*.
 Jap. J. Genet. 1931 : 6 : 137-42.
S. citrullifolium pollinated by *S. Delilei* gave fruits larger than those of the mother plant and intermediate in colour. If pollinated with *S. aggregatum* the fruits were smaller than either parent and the colour was intermediate.
259. PANKINA, A. 633.51:575.578.08
 (The subsidiary methods in the breeding and scientific investigation on cotton.)
 Bull. Sci. Res. Cott. Inst. Tashkent 1931 : 7-8 : 29-35.
 The success of any breeding work depends on the wealth of diversity of the original material. For this reason expeditions have been made and a collection built up which embraces all the diversity of all the cotton-growing countries of the world.

* A full summary of this paper is on file at the Bureau.

Among the material collected are varieties which under the conditions of Central Asia shew no signs of boll-production until advanced autumn. Over 500 specimens of these are under investigation and they possess a great number of very valuable characters. Some of these individuals have large bolls weighing up to 8 g. Early ripening Egyptian types with bolls weighing 3—3.5 g. have appeared. Many of the late types have proved highly drought-resistant, suitable for poor soils and resistant to a variety of diseases. The only difficulty is in inducing them to flower. For this purpose various methods have been tried, e.g.:

1. Transplantation after indoor germination during the spring frosts. A lengthening of the period of vegetation of two to three months was thus obtained and some of the late varieties were brought successfully to maturity.

2. Greenhouse cultivation of plants which in the field have failed to give seed. Various disadvantages of this method are enumerated and it is only used to a limited extent.

3. Grafting. By grafting on to early varieties, late ripening plants can be greatly accelerated in their maturity. Late plants which have not matured in the field are also grafted on to plants growing in the greenhouse and so brought to maturity.

4. Cuttings—with the object of enabling late ripening forms to complete their period of maturity in the greenhouse and also as a means of multiplying rare plants or valuable heterozygous plants obtained by hybridization, e.g., in the case of interspecific crossing, the hybrid *G. hirsutum* x *G. barbadense* being an example. The methods of taking the cuttings is briefly described. Many groups of cotton, e.g. *Gossypium punctatum*, are not capable of vegetative propagation in these ways and suffer severely even from transplanting; in no case were the results fully satisfactory and the search for better methods is being continued.

5. Length of day treatment. The cotton plant has been shewn to be a short day plant and by artificially reducing the period of insolation flowering and ripening can be very much accelerated. In this way perennial cottons have been made to flower simultaneously with the local ones and valuable crosses effected, e.g. Egyptian with large-bolled forms of *G. peruvianum*, resulting in a considerable rise in boll weight of the early Egyptian types. The progeny are now in F_2 and are being further analysed.

260. LUDWIG, C. A. 633.51:575"793"
Some factors concerning earliness in cotton.
 J. Agric. Res. 1931 : 43 : 637-59.

In the section on varietal variation it is shewn that the square period for upland is consistently lower than that for Egyptian cottons; the period for Sea Island is still higher. The order of the varieties with regard to boll period was also rather constant, the uplands being again the earliest. From this it is concluded that time of maturity is an inherited character and breeding for earliness should be possible.

261. NAKATOMI, S. 633.51:575.127.2:576.3
Hybridization between old world and new world cotton species and the chromosome behaviour of the pollen mother-cells in the F_1 hybrid.
 Jap. J. Bot. 1931 : 5 : 371-83.

Crosses were made between *G. herbaceum* and *G. hirsutum* and *G. herbaceum* and *G. barbadense* and the reciprocals. Seeds were obtained in each case except *G. herbaceum* ♀ x *G. barbadense* ♂ but germination only occurred in two seeds from the cross *G. hirsutum* ♀ x *G. herbaceum* ♂ and in one seed from *G. barbadense* ♀ x *G. herbaceum* ♂.

The hybrids shewed marked heterosis and were perfectly sterile either to selfing or backcrossing. The cytological investigations showed irregular heterotypic divisions with usually thirteen bivalents and thirteen univalents and the homotypic division was still more irregular so that in very few cases were only four pollen grains formed from one pollen mother cell but mostly five to eight and even ten.

No cytological investigations were made on the egg-cells.

262. HORLACHER, W. R. and KILLOUGH, D. T. 633.51:575.243:537.531
Radiation-induced variation in cotton.
 J. Hered. 1931 : 22 : 253-62.

The X-rayed seed gave reduced germination and a number of dwarf plants were produced. There also resulted various abnormalities of the cotyledons. In a virescent yellow strain, green tissue resulting in variegation was produced; the author regards this as a case of dominant mutation of a so-called "progressive" kind. Plants approaching the normal were also produced from an abnormal, forked-leaf type.

263. WARE, J. O. 633.51:677.21:575
Inheritance of seed weight and lint index related to hereditability of lint percentage in cotton.
 J. Amer. Soc. Agron. 1931 : 23 : 677-702.

Earlier work had shewn that in crosses between A, Pima x Winesap, B, Pima x Upright and C, Winesap x Sea Island, low lint percentage was intensified in A and B but that high lint percentage was incompletely dominant in C. These results are now further analysed and more data are provided on seed weight and lint index.

Hybrid vigour, affecting seed weight, was found to account for the low lint percentage in the A and B crosses. The parents of the C cross were not genetically pure for this character. When the weight of lint from 100 seeds was taken as a standard, dominance was incomplete in the F_1 of A and B and complete in C.

No, or hardly any, hybrid vigour in lint index was shewn in A, B or C. The investigations were continued in backcrosses and the F_2 generation.

264. VJELIZHEV, V. 633.51.00.15(47.7)
(Principal results of the work of the Kherson Experiment Station with cotton.)
 Bull. Sci. Res. Cott. Inst. Tashkent 1931 : 7-8 : 10-15.

Cotton cultivation in the steppes of Ukraine depends on the introduction of varieties which ripen sufficiently early to escape the frosts. Certain such varieties are referred to and the introduction of these, together with a number of cultural improvements also mentioned, has led to the reconstruction of the agriculture of these steppes.

265. HUDSON, P. S. 633.61:575
Zuckerrohrzüchtung im Britischen Reich. (Sugarcane breeding in the British Empire.)
 Der Züchter 1931 : 3 : 281-86.

An account of work in progress in India, Barbados, Mauritius and other countries in the British Empire.

266. MENDIOLA, N. B. 633.61:575(91.4)
The method of sugarcane breeding followed in the College of Agriculture at Los Baños.
 Sug. News 1931 : 12 (9) : 589-91.

A large collection of varieties from which to select parent varieties is kept and flowering data of these are recorded. The local wild *Saccharum* is largely used in hybridization.

In addition to artificial hybridization, natural hybridization and artificial selfing are employed. The methods in use are briefly described, including the various criteria made use of in the four distinct stages of selection.

267. CERESA, G. 633.61-1.547.25
Producción de "seedlings" de caña de azúcar. (Production of sugarcane seedlings.)
•Rev. Agric. Habana 1931 : 15-17.

A brief historical sketch of the progress of sugarcane breeding by means of self and cross pollination in various countries. For the production of practical results the author has decided to limit himself to self-pollination.

268. ROLDAN, E. F. 633.61-2.3
A bacterial stem-rot of hybrid cane seedlings hitherto unreported.
Philipp. Agric. 1931 : 20 : 247-60.

A description of a new disease which up to now has only affected hybrid seedling canes but which in the future may possibly also effect commercial varieties.

269. BRANDES, E. W. 633.61-2.8-1.521.6:575
Breeding for resistance to mosaic.
Facts about Sug. 1931 : 26 : 490-93.

The new species *Saccharum robustum* from Papua was found to be largely composed of individuals highly resistant to mosaic. Under Porto Rico conditions, however, the canes were no longer resistant.

The fact that resistance is conditioned by a number of factors is emphasized and attention is called to the complicated dominance relations. The author regards cytological examinations as an essential preliminary to any breeding work in the future. In spite of the discovery of the susceptibility of *S. robustum* the breeding programme of crossing it with *S. officinarum* is being continued.

270. DUDOK VAN HEEL, J. P. 633.63:575.11.061.6
Die genetischen Faktoren für Anthocyanbildung bei Zuckerrüben. (The genetic factors for anthocyanin formation in sugar beet.)
Der Züchter 1931 : 3 : 302-04.

Seed from plants having white buds in the second year of vegetation was sown separate from that of normal plants of the same family, having red buds, and gave all white seedlings, whereas the seed from the red plants segregated giving white and red. The white seedlings all had white buds in the second year.

Pure red and pure white types were crossed and produced a red F_1 , which when backcrossed with the white type gave a monofactorial segregation.

The bearing of these facts upon the methods of seed testing based on the colour of the seedlings is discussed.

271. NUCKOLS, S. B. 633.63.061.6-1.557
Seedling colour and yield of sugar beets.
J. Amer. Soc. Agron. 1931 : 23 : 740-43.

No correlation was found between the colour, red and yellow and either yield or sugar content.

272. HERLAN, H. 633.71:575
Phänologisch-züchterische Untersuchungen an den vier Haupttabaksorten Badens. ("Phenological" and breeding investigations on the four chief tobacco types of Baden.)
Arch. Pflanzenbau 1931 : 7 : 309-412.

The varieties proved to be very mixed and the varietal limits obscured as a result of natural and artificial hybridization.

The chief varieties represent selections from these four types and are rather uniform. The value of various characters as varietal characteristics is discussed.

By a study of these characters the author concludes that high quality and productivity can be by means of appropriate selection and treatment be combined in the same variety. The relative value of the different types for cultivation and breeding is indicated.

273. CLAUSEN, R. E. 633.71:575.061.633:576.312.36
Inheritance in *Nicotiana tabacum*. XII. Transmission features of
carmine-coral variegation.
Z. Züchtung 1931: A. 17: 108-15.

A study is presented of the inheritance of the carmine-coral variegation (see Plant Breeding Abstracts Vol. I. Abst. No. 403), supposedly due to the sporadic loss of a chromosome fragment. The behaviour in inheritance supports this view. The fluted (monosomic) plants contained a greater proportion of variegated individuals than the normals.

Certain self-carmine plants also appeared in the progenies of the variegated plants. It is difficult to account for the sudden assumption of stability on the part of the chromosome fragment carrying the dominant carmine.

Attention is drawn to the difference between this type of variegation, in which the dominant carmine is the continuous phase, and the classical examples of variegation.

274. RAVE, L. 633.71:575.14
Die Tabaksamengewinnung und ihre Bedeutung für die Züchtung. (The
production of tobacco seed and its importance in breeding.)
Z. Züchtung 1931: A 16: 548-57.

For the yellow flowers, since their flowers never open, self-fertilization is regarded as the rule. By their mode of flowering the red types give much more opportunity for cross-fertilization, in some varieties particularly. The author finds that yield increases are obtained by crossing two somewhat distantly related varieties but crosses of closely similar parents gave no such increases. However no adverse results were observed in a very large number of cases of obligatory self-fertilization.

The best type of bag found for isolation of the flowers is described. By continued selfing and selection very marked improvements and increased uniformity have been attained.

Experiments were made to test the number of capsules to leave on each plant in order to gain the maximum yield of seed. This number was found to vary with the type of inflorescence.

275. GOGH, V. W. VAN 633.72:575
Over theeslectie. (Tea selection.)
De Bergcultures 1931: 5: 638-42.

A hybrid is compared with an ordinary Assam type with respect to aroma, caffeine and tannin content and total soluble matter. The quality of the hybrid was clearly superior.

Individual yield tests were carried out on a large number of plants, including hybrids, and the best Assam and Ceylon types selected and multiplied by vegetative propagation. In one series quantity was the chief aim, in the rest quality took the first place.

Three plants were chosen for the final vegetative propagation, of which one was in particular outstanding in yield, the plantation produced from it giving 8000 kg. dry tea per ha. as compared with a normal of 800 kg.

The yields and quality of the vegetative progeny and the parent plants are to be compared.

276. COHEN STUART, C. P. 633.72:575.42(92.2)
Tea selection.
Proc. 4th Pacific Sci. Congr. Java 1930: 4: 277-84.

The Assam type in the first half of last century replaced the small-leaved Chinese variety owing to its being less susceptible to *Helopeltis*, having a heavier pecco and more vigorous growth.

Statistical studies have been made of the living material, involving measurements of the leaf length and width and their quotient, the number of serrations, the length of the tip, curvature and waving of the leaf.

Pollination studies—e.g. by isolating individual flowers under gauze, have shewn cross-pollination to be the rule.

Mass selection is preferred in general to individual seed selection and the vegetative propagation of hybrids from good parental combinations preferred to self-pollination which is only used in special cases.

As a result of continued cross-pollination in the past each tea plantation is a population.

At Tjinjirecan isolated plantations were set up in a patch of ground surrounded by jungle. Desirable characters are: vigour of growth, regular branching, large, supple, light green leaves and very little flower. All but the best individuals were removed at three successive examinations over a number of years. Seed could only be successfully obtained by planting budded trees from these plants at lower altitudes.

At Pondok Gedek Estate actual picking tests were made on 1100 shrubs, picked every nine days for one year and the yields weighed separately. The "production intensity" was taken as the yield divided by the picking area, so as to limit differences due to unequal age of trees, etc. The 75 best shrubs were retained for further investigation and seed production, also 39 medium and 54 poor ones for comparison.

It was calculated that five pickings were enough to judge the productivity of a shrub.

Grafts were made of good, medium and poor types and these planted out in three plots, together with a mixed plot. These shewed that most of the best leaf producers are hybrid types which flower profusely; they were not inferior with regard to resistance to *Helopeltis* and red rust. Apart from the superiority in quality of light green types, most exterior characters previously used as criteria have thus been shewn to be worthless. The product from the mixed plot was very much inferior and less uniform. Yield increases up to 50 per cent have been produced.

Production tests on topped two year-old trees are being tried.

Crown-grafting and budding are the only successful methods of vegetative propagation; the former is much cheaper.

277. WELLENSIEK, S. J. 633.72:575.42(92.2)
De tegenwoordige stand van de theeselectie. (The present position of tea selection.)
De Bergcultures 1931 : 5 : 1225-30.

The closest possible contact between the planters and the experiment station is advocated.

The products from the original selected seed are being compared. Individual yield tests are in progress on certain trees. A number of grafted trees will come into bearing in 1932, the grafting is not altogether successful, however.

Observations in the near future will shew to what extent the assumption was correct that the heaviest trees in the young stages (15 cm.) would later be the highest yielders. If this is so it is possible to apply a method of two consecutive selections of the 20 per cent "best" trees and thus avoid having recourse to vegetative propagation in making plots. It is possible that plant height or diameter are better criteria than weight. Plots to test these points are described. It is frequently desirable to select for type of plant as well as for yield.

The marginal plants are regarded as a separate group; 20 per cent of their best are taken and 20 per cent of the best plants of the rest. A method of lay-out is suggested in which marginal plants are avoided.

The best and worst trees so selected are being compared with unselected trees. These will give information on the inheritance of productivity.

The possibility of application of this method to large-scale practice is being tried.

The procedure would be quite different if a suitable method of vegetative propagation could be devised. There are strong indications that one method under test is proving successful.

A large collection of types is being built up and studied from the point of view—amongst others—of quality.

278. SCHWEIZER, J. 633.73:575.42(92.2)

The selection of *Coffea arabica*.

Proc. 4th Pacific Sci. Congr. Java 1930 : 4 : 265-70.

From the first appearance of the leaf disease *Hemileia vastatrix* there has been a rapid decline in the coffee cultivation in Java, especially of the *arabica* varieties. The Getas hybrid—a natural *arabica* x *liberica* hybrid was a success until the appearance of another disease "star bloom." No truly successful *arabica* hybrid was obtained in spite of continued attempts and the new *robusta* almost entirely holds the field.

The value of a certain number of types of *arabica* is indicated. A number of these were planted side-by-side with ordinary *arabica* in 1920 and observed, with special attention to fruit bearing and *Hemileia* resistance. Selfed seed was obtained from the best and those parent trees which produced the best seedling progeny were multiplied by grafting. A large collection of imported types and hybrid progenies is under examination.

Crosses were made in 1925 between *robusta* and *congensis* and *arabica* ; *arabica* x *congensis* hybrids are very promising and seem to have inherited the resistance of the latter parent.

It is intended to try grafting the F₁'s.

The possibility of creating a chimaera whose inner tissues are *arabica* and outer tissues *congensis* is absorbing interest, as also is the possibility of production of a constant hybrid between them.

279. LAMBERS, H. R. 633.73:575.42(92.2)

Historical review of the coffee selection in Java.

Proc. 4th Pacific Sci. Congr. Java 1930 : 4 : 191-201.

The first introductions, the failure of *arabica* cultivation owing to *Hemileia* and nematodes, the introduction of *liberica* and of its hybrid, a type with beans intermediate between *liberica* and *arabica* and which resisted the diseases for a time, are described. The hybrids had to be propagated vegetatively and led to a greatly increased development of grafting. This was followed by the introduction of *robusta*. It was very mixed and selection was soon applied. The selection work at four different estates is described. This consisted in comparing parent trees on the basis of the seedlings they produced by free-pollination. The best trees were multiplied by grafting and seed obtained from plots of these—thus more or less self-fertilized.

Selection was also continued with *liberica* and *excelsa*. The type known as *congensis* is also valued. Its progeny is very mixed and it must be propagated vegetatively.

Reciprocal crosses have been made between different *robusta* trees and between *robusta* and other types and a number of parents have been enclosed in gauze to ensure self-pollination and the seedling progenies compared.

280. BOREL, E. 633.73:575.42 ;

Sélection du caféier. (Selection of coffee.)

Bull. Econ. Indochine 1930 : 33 : 551-55.

The author recommends that from each plant to be tested, grafted progeny, as well as a plot of seedling progeny for yield tests, should be retained. When the yield tests have indicated which of the mother plants was the best, seed is taken from the original plant and from its budded progeny.

281. LAMBERS, H. R. 633.73:575.42(92.2)

De selectie van koffie. (Coffee selection.)

De Bergcultures 1931 : 5 : 684-95.

A discussion of the various test plantations on the experimental estate Soember Asin from 1906 to the present day.

The original parent trees of the present clones are no longer under observation and so selection must be carried out on the clones themselves. Good seedlings have been obtained and are under trial on various estates. In addition to the original *liberica* and *robusta* various other types have been included later, e.g. *excelsa*, Uganda, *canephora*, etc., and various new *robustas* of which

rob. Bangelan 108 is outstanding. A collection of types has been made from all possible districts and countries. Certain specimens from the Belgian Congo are particularly promising for seed selection.

The *canephora*s have not fulfilled the expectations and are being replaced by *robusta*.

A new, very uniform variety, differing from Uganda and *canephora*, yet resembling both, is described. The Jackson hybrids from India were not a success.

The author describes his selection experiments from 1926 onwards, in which selection has been practised for size of bean, etc. The yield figures for a number of selections over a period of four to five years are given. Selection at present is practised almost exclusively for regular high yields. Some of the trees under test were outstanding in quantity of yield, others in the regularity of their yields. It was evident that the high yields were not entirely confined to small-leaved forms and vigour of growth is much more important than type.

The best trees are propagated by seed and grafting and further tested. The best numbers are indicated, amongst which are certain ones apparently suitable for wet and others for dry conditions.

Hybridization has recently been undertaken to combine size of bean and yield; also crosses between different combinations of species.

With regard to various pests, the author thinks the possibility of getting true immunity is rather slight but has more confidence in resistant types which suffer less seriously from the attack.

Quality and other factors will be taken into account in later stages of breeding.

282. * LAMBERS, H. R. 633.73:575.42(92.2)

Vijfte verslag van de *robusta*-selectie op Banaran. (Fifth report on the *robusta* selection at Banaran.)

Arch. Koffiec. Ned.-Ind. 1931 : 4 : 101-10.

The contents of the four previous reports are reviewed briefly, giving an account of the selection work since its initiation.

Yield tests have been made of a number of promising mother trees and these compared with their respective progenies obtained from self-pollination (seedlings) and from grafting. Certain of these seedlings which appeared promising were also chosen and treated similarly, their seedling and grafted progeny being compared with the original mother trees and certain well-known lines.

Those mother trees which so far have given consistently the best yields are indicated. Neither the seedlings as a whole nor the specially chosen ones from amongst them have given strikingly good yields, although certain ones have been outstanding.

Attention is also given to quality, especially size of bean. Some of the seedlings had considerably larger beans than the mother tree.

Selections will be made when four years' results are available at the end of 1931.

283. BALLY, W. and REYDON, G. A. 633.73-2.223

De tegenwoordige stand van het vraagstuk van de wortelaaltjes in de koffie-cultuur. (The present status of the question of the nematode diseases of coffee.)

Arch. Koffiecultuur 1931 : 5 : 23-216.

In a short section at the end the authors state that *Coffea excelsa* is definitely not resistant. Systematic tests of resistance have now been set up and it is not thought impossible that by this means followed by selection amongst the progeny of apparently resistant trees, truly resistant forms will be discovered; the nematode itself is shewn to be capable of separation into different physiological races.

284. HAAN, J. T. DE 633.74:575.42(92.2)
 Review of the cocoa selection experiments in Mid Java.
 Proc. 4th Pacific Sci. Congr. Java 1930 : 4 : 257-64.

Five estates were laid out in 1912 and 1913 and the trees examined from the point of view of yield of fruits and of market product, infection by moth and *Helopeltis* and other pests, and quality.

On Djati Roenggo 12 mother trees and on Getas estate 33 were retained in 1913. In 1914 the trees were self-pollinated by removing all fruits and flowers but one and enclosing the tree under a calico cage. The production of seed was low.

In 1916 seeds of a forastero hybrid of the *Angoleta* variety were planted at Assinan and studied; 16 of the best trees were selected. From these, buddings and seedlings from free-pollinations were planted but later almost abandoned. A fresh start was made with them in 1924 and subsequent years up to 1928, when buddings were made.

At Djati Roenggo in 1916 isolated budded plots were set up for the production of seed. The seedlings fruited in 1918 and observations were made on their production. The buddings were not very successful.

In 1923 new seedling plots were laid out so that both seedling and budded progeny could be compared from 24 parent trees.

The yield differences remained constant from year to year for each tree, also generally speaking for the buddings and in many cases for the seedlings; yield of parent tree, clone and seedling are closely correlated. For certain trees this was not the case. Permanent hereditary differences also appeared to exist for susceptibility to *Helopeltis* and moth and for quality.

Two numbers are designated very good producers and four others as good. They will receive further observation. The yields of the various numbers, together with the average weight of market product and attack by moth and *Helopeltis*, are tabulated.

Certain trees are yielding up to 100 fruits per tree per year as compared with 50 for criollo and 30 for forastero.

Material for the study of sterility has been fixed.

285. COHEN STUART, C. P. 633.74:575.42(92.2)
 Selektie en selektieve uitdunning bij cacao. (Selection and selective
 thinning in cacao.)
 De Bergcultures 1931 : 5 : 16-18.

The yields of the progenies under observation proved to be on the whole parallel with those of the parent trees and on this basis further selections were made. The individuals which fell into the first 1/25 on the basis of yield tests were retained. The best individual yet observed produces 5.69 times the average yield. The individual yield figures of 1782 seedlings and other trees were taken. Never more than 4 per cent were retained.

In addition to yield, resistance to moth and *Helopeltis* and quality are now being taken into consideration.

Self-fertilization is being carried out on a large scale and more recently hybridization has been practised.

286. * COHEN STUART, C. P. and HAAN, J. T. DE 633.74:575.42(92.2)
 Verslag over de cacao-selektie in de jaren 1928 en 1929. (Report on cacao
 selection in 1928 and 1929.)
 Arch. Koffiec. Ned.-Ind. 1931 : 4 : 111-75.

A full account is given of the trials carried out at two estates in 1928 and 1929 and at the same time a number of the results of previous years are incorporated.

The yields of buddings from different mother trees varied within very wide limits, the best tree yielding 650 kg. per ha. per year of market product. Similar records were taken for seedlings from the different mother trees, the best tree of these giving 700 kg. The mother trees were also judged on the number of good yielders (with over 100 pods) in their progeny.

* A full summary of this paper is on file at the Bureau.

The individual yields of all the seedlings were subjected to statistical analysis and the limit of the upper quintile determined. This was 196 pods—i.e. one fifth of the individuals had 196 or over. Of these one fifth (bisquintile) were retained as outstanding individuals. The bisquintile limit was 287 pods. This method was applied to a number of other lots of material and its advantages are discussed.

Observations on attack by moth and *Helopeltis* were made in 1930 on the 40 best trees. Observations on stem diameter seemed to indicate that bearing starts rather suddenly when the diameter reaches 10 cm. There was a high but not absolute correlation between diameter and yield.

An examination of the position of the trees shewed a strong tendency for the high yielding trees to be near a gap.

The knowledge of the performance of individual seedlings and buddings obtained in this way was applied in selective thinning on the estates. Calculations are given shewing to what extent this is profitable.

True estimates of the value of a tree cannot be obtained from the tree itself but from its budded and seedling progeny. The necessity for properly arranged plot tests is emphasized and from a statistical examination of the individual yields of seedlings and buddings the minimum number of trees per plot was calculated. This was estimated as 100 (if possible 150) for seedlings and 20 for buddings.

The results up to date consist of a certain number of proved high yielders from three different estates and a number of imported types are under examination, the object being to improve the quality. Growth curves for individual trees are to be made, a satisfactory method of vegetative propagation is being sought, studies of fertility and sterility, the cytology of the flower and fruit and artificial pollination are projected.

287. WELLENSIEK, S. J. 633.74:575.42:575.061.6
Een nieuwe selectie-richting in cacao, gebaseerd op de Erfelijkheid van
zaadlobkleur. (A new direction for selection in cacao, based on the
inheritance of cotyledon colour.)
De Bergcultures 1931 : 5 : 960-62.

White cotyledons are associated with a better quality product than purple cotyledons. White cotyledons is shewn to be a simple recessive and thus in selection for high quality only the white types should be retained. Products of accidental out-pollination can frequently be detected by this means.

In the discussion following, the author states that it is quite possible to combine the good qualities of criollo and forastero by hybridization.

288. Iets over Cacao. (Remark upon Cacao.) 633.74:581.162.3
De Bergcultures 1931 : 5 : p. 1043.

An old cacao tree which previously had produced very little fruit was made to bear heavily by shaking vigorously in the morning and at midday for several successive days during the flowering season.

289. LAVERGNE, M. 633.855.341
Observations sur le palmier à huile. (Observations on the oil palm.)
Bull. Com. Afr. Occid. Franc. 1930 : 13 : 68-79.
Descriptions of various types and aborted fruit types which must be eliminated.

290. Cinchona culture in Java. 633.885.1
De Bergcultures 1931 : 5 : 481-96.

A rather brief historical account of cinchona cultivation and research, in which the greatest part has been played by selection for increased quinine content and the botanical type associated

with the Ledger plants. The best seeds were planted in isolated fields to ensure only inter-fertilization. By this means, followed by continued selection of the plants with the highest quinine content and vegetative propagation of the best trees, an increase of 25 per cent in quinine content was attained.

More recently other factors influencing the total quinine production have been taken into consideration.

The economic aspect of quinine production is discussed at some length.

291. SCHMÖLE, J. F. 633.855.34:575.42(92.2)

The selection of oil palms (*Elaeis guineensis* Jacq.).

Proc. 4th Pacific Sci. Congr. Java 1930 : 4 : 185-90.

The Deli type, imported into Sumatra in 1848 from Mauritius, is fairly constant although selection would probably produce a certain improvement. For this the ease of self or cross-pollination and the large number of seeds per palm are an advantage. There is, however, a great variation in oil content in the seeds from one palm, differences of as much as 25 per cent having been observed.

Individual yield tests have been carried out on estates since 1918 and isolated plots of the best palms from controlled pollinations have been laid out; on the basis of the yield figures the poor palms will be rejected and superior seed so obtained.

Artificial crosses have also been made and observations on yield and oil content are to be made on the resulting palms. These F_1 palms will also be used to produce seed by self-pollination and the F_2 progeny observed.

The Africa types are very variable with respect to the thickness of the seedcoat and only very few are of any cultural value and none breed true. Four types are distinguished on the thickness of the shell. An F_1 from controlled pollination of certain of the best palms has been made in the hope of obtaining a good true-breeding type.

In practice only seed obtained by controlled pollination of known good parents should be used.

292. HOOP, J. N. VAN DER 633.912:575

Over Hevea-zaad, zaailingen en oculaties. (Hevea seed, seedlings and buddings.)

De Bergcultures 1931 : 5 : 1020-27 and 1053-56.

A summary description of the handling of the seed under observation. The yield of seed per tree and per clone is checked. Observations on artificial pollination are in progress, also on the seed germination. Budded trees gave a higher percentage of bad seed than trees not budded. A certain number of particularly good trees have been found amongst such progeny however.

293. VRIES, O. DE, SCHWEIZER, J. and OSTENDORF, F. W. 633.912:575.42(92.2)

Selection of *Hevea* in Java.

Proc. 4th Pacific Sci. Congr. Java 1930 : 4 : 157-71.

A number of difficulties in the way of *Hevea* selection are mentioned, e.g. the amount of ground and the length of time required, the lack of any indicative feature as to the yield of a tree other than direct test, the influence of tapping methods and various physiological factors on yield, the rapid loss of germinating capacity of the seed, the difficulty of artificial pollination and low seed production of many of the best trees.

The material at present is very variable. This and the perennial nature of the tree, the ease with which budding can be accomplished and the characteristic type of the seed of each tree stand in favour of selection.

The various importations of *Hevea* seed into Java are enumerated. All later imports have proved inferior to the original Wickham material. Observation and selection have been in progress since 1914 and controlled seed was obtained in 1925.

Systematic observations of a number of outstanding mother trees from the point of view of yield, type of yield curve, resistance to diseases, time of wintering, etc. were started about this time. Many of these trees now yield an average of over 150 gm. dry rubber per tapping.

As early as 1917 seed from uncontrolled pollination of the best mother trees was sown and tapping tests made on the seedling trees. Considerable differences were evident between the progenies of the different trees but the seedling progenies proved much superior to ordinary unselected material.

Seed from artificial pollinations was difficult to obtain, but extensive series of crosses and selfings were done in successive years starting with 1922.

Isolated patches consisting of high-yielding clones only were therefore planted, from which abundant seed has been obtained.

Very few trees gave budded progenies equal to the seedlings; a few trees were discovered, however, which yielded highly productive clones.

Various questions relating to vegetative propagation have been studied and the results are discussed.

294. HOOP, J. N. VAN DER. 633.912-1.547.25

De correlatie tusschen opbrengst en stamomtrek bij oculaties en zaailingen.

(The correlation between girth and yield in seedlings and buddings.)

Arch. Rubberc. Ned.-Ind. 1931: 15: 329-44.

The correlations between girth and yield for seedlings of the same parent tree were 0.4 to 0.6 as compared with correlations of up to 0.805 for a vegetative clone originating from the same tree.

295. VOLLEMA, J. S. 633.912.00.14-1.421

Over de methodiek van veldproeven in de rubbercultuur. (On the methods of field experiments in rubber cultivation.)

Arch. Rubberc. Ned.-Ind. 1931: 15: 391-422.

The number of trees and of repetitions considered necessary for various types of test is given.

296. PISSAREV, V. E. 633.913:575(47)

(The problem of guayule breeding in U.S.S.R.)

Subtropics 1930: 2 (3-4): 33-50.

It is pointed out that the cultivation of guayule will only be possible if cold-resistant forms can be found or bred. Hope in this respect is derived from the great differences which exist between the various "botanical forms"; some of these displayed a considerable degree of resistance and it is thought that this should be increased by breeding.

A similar position is indicated with regard to drought resistance, which is also essential on account of the much drier nature of the Russian subtropics than the original habitat of guayule in Mexico.

A number of plants were selected on account of their marked resistance compared with the rest. An examination of these shewed that two "botanical forms" accounted for most of the drought and cold-resistant plants.

Plants were also found which contained up to 18 per cent of rubber, compared with 10 per cent for the wild plants. Great variations are also to be observed in the proportions of rubber and resins.

The floral biology has to be studied from the beginning, accompanied by a study of the best means of isolation for ensuring self-pollination. This shewed that the plant tends to be self-pollinated, with occasional out-pollination.

A successful method of emasculating the inflorescence was worked out. The successive phases of flowering were observed and are enumerated and the best times for collecting pollen and effecting pollination, etc., indicated.

The "botanical forms" differed in their tendency to self-fertilization. The experiments proved that pollination takes place usually within the inflorescence, the male ray florets playing the chief part and the pollen being carried by insects and not by the wind. No apogamy was observed. The most successful method of ensuring self-pollination was spatial isolation. The set in this case was equal to that under normal conditions of free pollination, which however, varied considerably from place to place.

The programme for further breeding is outlined.

297. * PISSAREV, V. E. 633.913:575
(Breeding and methods of cultivation of the guayule.)

Bull. Appl. Bot. Genet. and Plant-Breed. 1930 : 24 (3) : 3-84.

A detailed account of the work described briefly in the foregoing paper.

298. KALASHNIKOV. 633.913:581.162.3
(A contribution to the biology of flowering in *Parthenium argentatum* Gray.)

Bull. Appl. Bot. Genet. and Plant-Breed. 1930 : 24 (3) : 85-98.

The flowering depends chiefly on water supply and can be induced by suitable irrigation.

The inflorescence, flowers and fruits are briefly described and illustrated and the nature of the insect visitors observed is discussed. The flowering takes place almost entirely during the day. The order of flowering is described and the author was led by a study of this to regard the time when the stigma is just beginning to dry as the most suitable for pollination. This phase is usually reached about five to six days after emasculation.

The functionally male flowers complete their flowering much more rapidly, in two or even one day; they consequently flower at the time when the female flowers reach the above-mentioned phase suitable for pollination. The best time to collect pollen is between 11 a.m. and 2 p.m.

The method of emasculation was to remove the central, functionally male flowers and apply pith to prevent damage to the inflorescence.

Inflorescences were also isolated for self-pollination, giving a success of 17.9 per cent. Isolated emasculated inflorescences gave no cases of apogamy. By artificial pollination with pollen from the same plant a success of 7.08 per cent was obtained.

By isolating and excluding insects and wind very little fertilization occurred—0 per cent for single inflorescences, 0.29 per cent for whole flowering stalks. In emasculated inflorescences left free, on the other hand, 4.71 per cent success was obtained, by protecting from insects by means of material permeable to pollen, 0 per cent. Pollinations with pollen from another plant gave 11.61 per cent. The possibility also of natural cross-pollination is not excluded.

299. JOHANSSON, E. 634.1/2:581.162.5
Blombiologiska försök med fruktträd vid Alnarp 1926-1930. (Pollination experiments in fruit trees at Alnarp 1926-1930.)

Sverig. Pomol. Fören. Årsskr. 1931 : 1-34.

This is a continuation of work done in 1923-25 and published in 1926.

APRICOTS.

One variety from Breda set hardly any fruit when either cross or self-pollinated. The other two varieties tried, one from Tours and Ambrosia, were both self-sterile.

CHERRIES.

Eighteen varieties of sweet cherries and four hybrids were used. All were self-sterile. Montmorency, though sometimes setting fruit, must be considered for practical purposes to be self-sterile. Inter-sterile groups were found. Allmän gulröd bigarreau and Elton had pollen with poor germinating capacity. Rivers Early is considered an ideal variety for purposes of cross-pollination.

* A full summary of this paper is on file at the Bureau.

The research has further confirmed that good fruit-setting can be obtained in sweet cherries when pollinated with sour cherries.

PLUMS.

Varieties introduced from abroad were investigated as well as local varieties, as different results were observed under different conditions.

No case of inter-sterility was met with and many varieties were self-fertile.

PEARS.

Marguerite Marillat in Sweden produces very little pollen, most of it bad and it is therefore self-sterile. In England it is described as self-fertile. Experiments, while not conclusive, were against parthenocarpy.

No case of inter-sterility was observed.

APPLES.

Fifty-four varieties investigated of which none can be said to be markedly self-fertile.

The correlation between pollen germination and number of seeds is discussed.

300. SOLANIKOV, P. E. 634.22:581.162.52
(Self-pollination of plums at the Sochi Experiment Station.)
Subtropics 1930: (5-6) 2: 51-62.

One branch of each variety under test was left free to natural pollination, a second was isolated and artificially pollinated with pollen of the same branch and a third was isolated and left untouched.

Many of the varieties proved to be quite self-sterile. A second group gave fruit under artificial self-pollination although less than in the control, a third group seemed to be quite self-fertile. These gave more fruit in the artificially self-pollinated branches than in the controls.

In some of the self-fertile varieties the artificially pollinated fruits were larger than the controls. The varieties fell into three groups, viz. those in which the pistil emerged on the same day as the opening of the flower and the stamens matured the same day; those in which the pistil emerged but the stamens did not mature until the following day; and those in which the pistil developed before the opening of the flower and the stamens at the time of opening or later. These, however, did not altogether correspond to the fertility groups.

301. KOBEL, F. 634.23:581.162.5
Selbststerilität und Intersterilität bei Kirschensorten. (Self-sterility and
intersterility in cherry varieties.)
Verh. Schweiz. Naturf. Ges. 1930: 111: 308-09.

Four intersterility groups were found, varieties within the same group being sterile, varieties of different groups always fertile.

302. SOSNOVSKY, D. 634.25:575.127:634.551
(A hybrid between peach and almond.)
Bull. Appl. Bot. Genet. and Plant-Breed. 1930: 24: (2) 189-203.

Descriptions are given of certain hybrids which for some time have been growing in the Botanical Garden at Tiflis.

The trees are of more than average productivity and bear almost every year. They are rather resistant to fungous diseases, cold and drought and not exacting regards soil. The fruits resemble the peach but the juiciness is intermediate between the two parents; the fruits are rough, bitter and not edible. The seed is also bitter.

The fruit splits at the time of opening; the vegetative characters also resemble the almond. The diploid chromosome number is sixteen as in the parents.

No case of two different types of fruits occurring on the same tree has been observed.

Certain differences between these hybrids and others described in the literature are pointed out,

in which connection the author remarks that such hybrids may arise from a variety of different forms of the parental species. The first generation hybrids resulting from artificial hybridization and the progeny from the hybrid plants shewed a great variety of types, particularly with regard to leaf form, of which the different types are described.

The hybrids are expected to make valuable stocks for many fruits of the peach or almond type, being of strong growth and very free from diseases.

303. HUSTED, L. 634.58:576.312.35
Chromosome number in species of peanut, *Arachis*.
 Amer. Nat. 1931 : 65 : 476-77.

Root-tip examinations of six varieties of *A. hypogaea* and one variety of *A. nambyquarae* shewed the diploid number to be forty in all cases.

304. JACK, H. W. 634.61:575
Improvement of the coconut crop by selection.
 Proc. 4th Pacific Sci. Congr. Java 1930 : 4 : 15-23.

The relative productivities of the trees examined remained the same over a period of eight years, as shewn by the annual yields of ripe fruits which are tabulated.

The range of variation is shewn by a second table to be from 5 to 115 nuts. The average annual yield of copra per acre was 1510 lb. and the number of nuts 2,986.

The coefficient of variation for productive capacity of all palms was 34 per cent of the mean, which amply illustrates the possibilities of improvement by selection. In addition to the variation in fruit production the copra production per nut was characteristic for each palm and varied between 72 and 131 per cent of the mean. The variation occurring even within a group of selected palms are shewn by the figures tabulated. Many of the best palms yielded more than 50 lb. of copra per annum and it is calculated that the use of such palms would give a 50 per cent increase in yield on that of a normal plantation.

305. DARROW, G. M. 634.715:575.12
European blackberry seedlings and hybrids.
 J. Hered. 1931 : 22 : 143-46.

The Evergreen, Cut-leafed or American Cut-leaf and the Himalaya, both horticultural varieties of blackberry, are extensively grown and both are of value for different commercial purposes. When crossed in the hope of combining their qualities only two true hybrids were obtained, of no value, the rest being apparently false hybrids.

In the wild, very little variation was found in the Evergreen and apogamy seems to be the rule. The variations found are probably the result of sexual fertilization.

Much more variation was found in the Himalaya, probably the result of selfing and possibly of crossing with Evergreen.

False hybrids have not been reported in American bush blackberries.

306. YARNELL, S. H. 634.75:575.127.2:576.3
Genetic and cytological studies on *Fragaria*.
 Genetics 1931 : 16 : 422-54.

The results of numerous crosses between the diploid species *inter se*, between diploid and hexaploid, diploid and octoploid and between octoploid *inter se* are described.

The diploid species investigated fell into four groups according to morphological characters, crossing-relationships and fertility.

Cytological examination of the diploid-octoploid hybrids revealed many irregularities and the occurrence of auto- as well as allosyndesis. Some plants had unexpected chromosome numbers but all followed the polyploid series.

There were indications that chromosome pairing increased with an increase in temperature.

The appearance of plants resembling the female parent is assumed to be due to some form of pseudogamy.

307. YARNELL, S. H. 634.75:576.356.5
A study of certain polyploid and aneuploid forms in *Fragaria*.
Genetics 1931 : 16 : 455-89.

The inheritance of pink colour was studied in the tetraploid progeny of a cross *F. bracteata* Heller x *F. vesca rosea* Rost. The plants were backcrossed to the white *vesca*, *F. americana alba*, to *F. bracteata* and selfed. The results shewed that there is chance association between homologous chromosomes. Some lagging of the chromosomes was occasionally observed during reduction division.

The tetraploid could be crossed with the diploid with relative ease when the tetraploid was the male parent, the reciprocal was less easy. The progeny were triploid and only slightly fertile. Crosses with the hexaploid were successful only when the tetraploid was used as the female parent. The hybrids were sterile. These conditions were reversed in the case of the cross with the octoploid.

Some of the triploid plants shewed a great deal of variation, especially in leaf shape, and investigation shewed that they had either one chromosome more or one less than the normal 21. The seven expected $3n + 1$ types have been found and are described and four of the possible seven $3n - 1$. Non-disjunction or elimination of chromosomes is responsible for their occurrence.

Among the progeny of triploid x diploid, plants with 15 chromosomes and shewing variation occurred, some of which were similar to the $3n + 1$ plants others were quite different.

The causes of sterility of the diploid and of the variation in all the groups is discussed.

308. COLLINS, J. L. 634.774:575(96.9)
Characteristics of the canned fruit of hybrid pineapples—results of
the seedling cutting bee for 1930.
Pineapple Quart. 1931 : 1 : 26-39.

The quality of a number of hybrid seedlings is reported in tabular form and it is shewn that the variety Cayenne enters into the parentage of all the most promising hybrids.

309. COLLINS, J. L. and KERNS, K. R. 634.774:576.312.35
Genetic studies of the pineapple. I. A preliminary report upon the
chromosome number and meiosis in seven pineapple varieties (*Ananas*
sativus Lindl.) and in *Bromelia pinguin* L.
J. Hered. 1931 : 22 : 139-42.

Twenty-five was found to be the haploid number of chromosomes at meiosis and fifty were observed in dividing cell of the root tip. Meiosis was regular, lagging chromosomes and other abnormalities were rare.

Six triploid plants were obtained in the F_1 of a cross between Cayenne and a wild Brazilian variety. There were 75 chromosomes and meiosis was irregular. A similar case may account for Heilborn's report of 75 as the somatic number in his material.

The haploid number for *Bromelia pinguin* L. was found to be 48.

310. HUSFELD, B. 634.835
Rebzüchtungsfragen unter besonderer Berücksichtigung der Arbeiten des
Kaiser-Wilhelm-Institutes für Züchtungsforschung in Münchenberg i. d. Mark.
(Grape breeding questions with particular reference to the work of the
Kaiser-Wilhelm-Institute für Züchtungsforschung in Münchenberg
i. d. Mark.)
Weinbau Kellerwirtschaft 1930 : 9 : 55-58.

All American and European species, varieties and hybrids have the same chromosome number and interspecific crosses are therefore very profitable. Seedlings are tested first for resistance to fungus diseases, the immune varieties are then tested with *Phylloxera* and with regard to their quality as wine producers.

The parentage and genetical constitution of many of the common varieties are very uncertain. On selfing American x American and testing with *Peronospora* a ratio of immune to susceptible of 1 : 1 was obtained. The progeny of European x American F_1 hybrids, consisting of 8,900 F_2 plants, contained 7,480 susceptible and 585 immune.

A solution of the problem of direct producers is expected from a large plot of Mourvèdre x Rupestris 1202 C.

311. STEINGRUBER, P. 634.835.093:575.11.061.633
Beiträge zur Genetik des Weinstockes. (*Contributions to the genetics of the vine.*)
Das Weinland, 1931 : p. 55.

The author concludes that three factors are concerned in governing chlorophyll development, rather than one as stated by other writers.

312. BARANOV, P. and RAJKOVA, H. 634.851:576.16
("Wild" grapes of Asia Media.)
Bull. Appl. Bot. Genet. and Plant-Breed. 1930 : 24 : (1) 319-51.

An account is given of the ecological conditions of growth and the morphological features of the wild types. There was no dividing line between the wild and cultivated forms, all belonged to the type *Vitis vinifera* and many of the cultivated forms were also found wild. A detailed summary is given of the characteristics of both forms side by side and it is concluded that the vast range of cultivated grape types is the result of a large variety of wild forms having been taken into cultivation. This region seems to afford an illustration of the conditions under which this has come about.

313. IVANOVA-PAROISKAYA, M. 634.851:581.162.51
(The sterility of the pollen in the "female" grape varieties of Asia Media.)
Bull. Appl. Bot. Genet. and Plant-Breed. 1930 : 24 : (1) 93-166.

The literature is discussed fully, the "female" flowers and the development of pollen and embryo sac in them are described and figured for three "female" varieties and two similar wild types. No transitional forms towards the "male" or hermaphrodite type, such as have sometimes been reported in the literature, were found and the authoress doubts their existence.

Inflorescences isolated for self-pollination flowered normally but then most of them almost entirely dried up and the flowers fell off, owing to the low percentage of fertilization. Frequently small grapes were formed and although the pollen was incapable of fertilization it apparently had some stimulating action on the development of fruit. Microscopic examinations shewed that the seed might cease development at various stages, attaining sometimes half its normal size ; but in no case did the endosperm and embryo develop. The size and weight of the clusters and fruits obtained by self-pollination are given.

When applied to emasculated flowers of a hermaphrodite variety and when tested in artificial germination media the pollen proved to be 100 per cent sterile. The pollen grains were seen to be devoid of pores. The sterility did not seem to be influenced by external conditions. No case of parthenocarpy was observed.

Artificial pollination after emasculation and mass pollination without emasculation were performed with both European and Mid-Asiatic hermaphrodite forms and wild "male" forms and gave perfectly normal fruit development.

The sterility is thought to be conditioned by some fundamental characters of the forms possessing it, in addition to the part played by the absence of the pore ; these must be the cause of the nuclear degeneration observed in the development of the pollen grains. This degeneration occurs only after the formation of tetrads, which occurs in a perfectly normal manner.

314. MARCHI, V. 634.872:575
Risultati di miglioramento genetico di alcuni vitigni di uva da tavola. (*The results of the genetical improvement of some vines of dessert grapes.*)
Ital. Agric. 1931 : 68 : 529-39.

Because the grafting on to American stocks was effective against phylloxera in the case of dessert grapes, their hybridization was not much studied. In 1899 Luigi and Alberto Pirovano began to cross the local vines with other viniferas in the hope of attaining a better stock. The work was continued with local varieties to improve them especially for local conditions. More progress was made when the biology of the flowers was better understood and a better method of artificial hybridization introduced. The advantages of heterosis could be continued by vegetative propagation.

Pirovano considers that the characters of an individual are not static units but are actual elements in a state of equilibrium. He chooses as the seed parent the more robust variety and for the pollen parent, the variety with the desired delicacy and flavour. The great number of good varieties obtained is attributed in part to having been able to cross varieties growing in quite different soils.

Great complications are encountered because of the extreme heterozygosity of the vines grown but much knowledge has been acquired for future use. Electro-magnetic experiments are also in progress.

Of the 3200 plants obtained by crossing only a few have been chosen by Pirovano and the following varieties are described: Delizia di Vaprio, Italia, Aurora, Angelo Pirovano and Perlona. Many others are still being tested. One, the result of a cross between Moscatellone x Sultanina Bianca is quite seedless and has the muscat flavour.

Three other promising hybrids are the result of the cross No. 59 (Bicane x Poeta Matabon) x Zibibbo. One, No. 108, crops twice, at the end of August and the end of September.

315. HUCHEL, A. *Wieviel Ertrag bringt eine Spargelpflanze? Ein Spargel-Selektionsversuch. (What yield does an asparagus plant give? A selection experiment with asparagus.)* *Obst.-u. Gemüsebau* 1931 : 77 : 635.31:575.42

Exhaustive examination showed that marked differences between individual plants exist with regard to number, weight and earliness of stems. Of the plants examined 52 per cent were male, 44 per cent female and the rest bisexual. The male plants gave more than double the yield of the female ones.

316. KISSLYAKOV, P. A. *(The cultivation of cauliflower for seeds.)* *Bull. Appl. Bot. Genet. and Plant-Breed.* 1930 : (2) 205-34. 635.35:575.14

The difficulty of producing cauliflower seed and the consequent high prices are discussed. Commercial varieties were sown in Azerbaijan and subjected to botanical examination—to select pure lines—and self-pollination.

The influence of the time of sowing on the success of cultivation commercially and for seed were studied. This, although it had a very marked effect on the vegetative growth, had little or no effect on the time of flowering or ripening of seeds.

In a study of the constancy of various characters the length of the stalk and the size of the head proved to be of lesser value. Of much greater constancy were the size and colour of the seed. Judged by this character the common varieties proved to be very heterogeneous.

Self-pollinations were made of 240 individuals; the percentage success for cauliflower was 13, for broccoli 12.8 and it is thought that much higher percentages would have been obtained had a better isolating material been used than parchment, which proved unsuitable for the hot climate of the station. The plants obtained from self-pollination were as good and even better than plants obtained in the ordinary way.

The yield of seed per plant for various varieties is given. These are extremely high and the neighbourhood in question is evidently peculiarly suited to the production of cauliflower seed. The conditions are such that the two phases required to produce seed can be produced in the course of one year.

317. DITMER, E. E. *(On the question of the origin of cultivated Phaseolus.)* *Bull. Appl. Bot. Genet. and Plant-Breed.* 1930 : 23 (5) : 309-406. 635.652:576.16

The author reviews the literature on the genus *Phaseolus*.

The greatest number of species are found in Mexico, Brazil taking second place. Mexico also has the largest number of endemics. The systematics of the genus are discussed.

The genus is regarded as having nearly reached the limit of its development and most species are falling out of cultivation. A key to the determination of the varieties is given.

From a full review of references to the crop in ancient literature and the results of recent expeditions the author concludes that *Phaseolus vulgaris* is probably of Mexican origin. *P. multiflorus* is also ascribed to Mexico, Guatemala and Columbia; the flat varieties of *P. lunatus* have apparently originated in Mexico and Guatemala and the spherical forms in Yucatan. Botanical descriptions are given of other sections of the genus.

318. MACKIE, W. W. and ESAU, K. 635.652-2-1.521.6:575
A preliminary report on resistance to curly top of sugar beets in bean hybrids and varieties. (Abst.)
 Phytopathology 1931 : 21 : p. 997.

Various hybrids and varieties of *Phaseolus vulgaris* were tested with curly top, *Eutettix tenellus*. From crosses of a white bean resistant to mosaic and a pink bean resistant to curly top, both white and pink segregates resistant to both diseases were secured.

319. ISBELL, C. L. 635.652-2.223-1.521.6
Nematode resistance studies with pole snap beans.
 J. Hered. 1931 : 22 : 191-98.

Selections were made for resistance to nematode attack and one selection was obtained which in a number of tests was almost, if not completely, immune and not inferior in eating quality or yield.

320. GOVOROV, L. I. 635.656(63)
 635.656:576.16
(The peas of Abyssinia. A contribution to the problem of the origin of cultivated peas.) Essay II.

Bull. Appl. Bot. Genet. and Plant-Breed. 1930 : 24 : (2) 399-431.

As the result of a previous study Afghanistan was regarded as one of the chief centres of origin of the pea, on account of its great wealth and diversity of forms and of dominant characters. Abyssinia proves to be an independent, primary centre. The general characters of the three flower colour groups are described and the characters used in their further classification discussed; the classification is then given in full and the sub-species described.

A study of the distribution of the sub-species and varieties shewed that the greatest richness and variety of forms was found in certain small areas at high altitudes, certain dominant forms occurring only in these areas; it was sometimes possible to find as many as 15 of the 20 sub-species in a single sample. Passing from this centre towards the north and to lower altitudes there is a gradual change from these dominant types to clearly developed varieties displaying a constantly increasing number of recessive characters. It is therefore concluded that the varieties have originated by some cross in the past between two sharply differing sub-species.

Hybridization experiments have shewn that the sub-species *abyssinicum* is more nearly related to the wild species *P. fulvum* than any other; the F_1 of these two shews a considerable proportion of fertile flowers.

Certain genes, such as the dentation of the leaflets, appear to have passed from the Abyssinian centre towards the Afghan centre, being found for instance in Persia in conjunction with a number of typically Asiatic genes. On approaching the Afghan centre the number of such genes diminishes.

The Abyssinian forms were less affected by reduced length of day than the Asiatic forms, shewing more similarity to the Mediterranean forms.

On crossing the Abyssinian forms with the Asiatic a tremendous range of forms was obtained in F_2 , some being non-viable, indicating a great wealth of genes in the forms from the distribution centres and the possibility of obtaining very valuable new forms by hybridization. Three new genes for flower colour were discovered in the first genetic tests. Certain genes are identical in both centres and a table is given of the genes which are already known to distinguish the two centres.

Certain forms ripening earlier than all other forms in the nursery are expected to be of great value for hybridization.

321. PELLEW, C. and SANSOME, E. R. 635.656:575.11:576.356.1:581.162.5
Genetical and cytological studies on the relations between Asiatic and European varieties of *Pisum sativum*. I. Partial sterility in hybrids of a Thibetan and a European variety. II. Chromosome association in *Pisum*.
 J. Genet. 1931 : 25 : 25-54.

A Thibetan variety was crossed with the European variety Duke of Albany from which it differs in several characters. Some of the F_1 plants were partially sterile, the rest completely fertile. The progeny of the former was examined in F_2 and among it were plants with 50 per cent pollen and ovule sterility. The factors for round and wrinkled cotyledons were found to be connected with partial sterility and cytological investigation shewed these plants to possess a ring of four chromosomes, absent in the fertile plants and caused by a segmental interchange between non-homologous chromosomes. Partial sterility is associated with non-disjunction of the ring. The number and distribution of the chiasmata were investigated.

322. PELLEW, C. 635.656:576.356.1
"Note on irregular gametic series in *Pisum sativum*."
 Z. Züchtung 1931 : A. 17 : 90-92.

Two cases of chromosome association have been observed in semi-sterile plants, one involving the colour-white, Aa, factor and the other the round-wrinkled cotyledons, Rr. Data are presented which indicate that these two factor pairs are linked.

323. KAYSER, E. 635.835.094
Contribution à l'étude des vins d'hybrides. (Contribution to the study of the wines from hybrids.)
 Rev. Vitic. Paris 1931 : 38 : 187-89.

The analysis figures for various direct producer hybrids are given and it is shewn that the wines are of perfectly good quality such as the market demands.

BOOK REVIEWS.

- TIPPETT, L. H. C. 519.21
The Methods of Statistics. An introduction mainly for workers in the biological sciences.

Williams and Norgate, Ltd., London, 1931. 220 pp. 15/-.

Of recent years statistical research has developed a great deal, mainly in response to the need felt by biological and other workers for exact methods for dealing with their experimental data. R. A. Fisher's book, "Statistical Methods for Research Workers," broke much new ground, and is regarded nowadays as an almost indispensable laboratory manual. Tippet's book is conceived along much the same lines, and contains a very readable account, non-mathematical in character, of the main portions of the subject. Examples abound, and the treatment of some difficult subjects, such, for example, as the exact nature of tests of significance, is very full. If anything the book suffers a little from looseness of definition, and there are a few minor errors, but these should not trouble the critical reader. In some places the author expects the reader, who is excused simple proofs, to master without much explanation the more difficult question of mathematical notation, e.g. summation signs. No worker is completely equipped without tables, and it seems a pity that our author does not furnish these, for the principal source recommended is another text-book, which is an unsatisfactory position. A section of particular interest to plant-breeders is that on principles of experimental arrangements, and it was perhaps inevitable in a general book of only some two hundred pages that this section should be comparatively restricted in scope. The experimentalist will have to wait a little longer for the fuller treatment for which a demand undoubtedly exists. In spite of this, the book should make an appeal to a wide class of reader, and is fully deserving of study by any worker who has need of statistical methods.

Baillière's Encyclopaedia of Scientific Agriculture.

Baillière, Tindall and Cox, London, 1931, 2 Vols., 1362 pp., 29 plates. £3 3s.

The results of scientific investigations in connection with agriculture are usually published in one or other of the many journals devoted to the respective branches into which work in this sphere is rapidly being segregated. But the articles found in publications of this character, in addition to their multiplicity, which is assuming the character of an embarrassment to even the most assiduous reader, usually deal with only a particular phase of a subject. Thus the reader frequently fails to visualize a problem as a whole, and more particularly its relation to cognate problems.

This Encyclopaedia has been written with the object of picturing agriculture under the influence of scientific enquiry to which every branch of the industry is now being subjected. Those portions of the Encyclopaedia that deal with the practical application of results are written for the benefit of the farmer, but there are throughout full references to the investigations which form the basis of recommendations and the scientific worker is thus enabled to amplify the information given whenever he finds this necessary.

The articles on cereals deal in the main with those crops as found in the British Isles, but the plant-breeding problems involved here are in reality only an amplified or modified phase of those common to all cereal-growing countries in the temperate zone. Consequently, although the reader in some cases may be acquainted with other than the varieties mentioned, he secures the benefit of contrast, for the direction of desired improvements is much the same the world over. Again, Great Britain is still the largest grain-importing country and the character of her requirements in this direction is thus a matter deserving close attention in exporting countries.

Market gardening in this and other countries is rapidly assuming an important economic position and the prospects of securing improved plants by breeding are discussed in an article on Vegetable Breeding.

Our knowledge of Virus diseases, more particularly the character of their manifestations in plants and mode of infection, is increasing rapidly and, as would be expected, this subject receives considerable notice especially in relation to Potatoes and Tomatoes.

Resistance of various plants to different fungoid diseases is also dealt with and in an article entitled "Insects, Measures of Controlling" there is a highly interesting account of some of the cases of plants that prove resistant to certain insect pests. The breeding of crop plants that are resistant to pests to which they act as reluctant hosts is a line of large possibilities, perhaps more particularly in tropical countries, although even in the British Isles we have many that limit the more extensive use of certain crops.

Another article amongst many to which plant breeders may turn with advantage is Winter-hardiness and Drought Resistance, for most breeders touch upon one or other of these conditions in some form in the course of their investigations.

The Encyclopaedia does not claim or aim to be a text-book in any subject, but rather a philosophical exposition of scientific agriculture, and it will be noted therefrom that the final answer to many problems is still wanting. In some cases there may not be any forthcoming in exactly the terms we desire, but there is surely no work that in the doing fails to concede some step to progress, however divergent from the immediately desired direction it may be.

Dix, W. *Praktische Pflanzenzucht auf theoretischer Grundlage. (Practical plant breeding on a theoretical basis.)* 633:575

J. Neumann, Neudamm 1931: pp. 250, Price, paper cover 15 RM, cloth 18 RM.

The book under review is a somewhat original contribution to the existing literature on plant breeding. It is written very much from the point of view of those who follow the German methods of plant breeding, where much of the breeding is in the hands of commercial organizations or private breeders. It takes the form of a series of discussions on different problems which concern the breeder, which incorporate a more or less popular explanation of the problem for those not versed in the science, deliberations on various aspects of the problem, in which the practical side is emphasized and illustrated by examples frequently drawn from the author's personal experience. Many of the problems are regarded from an original point of view and new explanations are offered for a number of phenomena.

The author makes a very clear distinction between the improvement of existing types by selection and the creation of new types by hybridization, etc. ; the problems are treated in separate sections of the book.

After a discussion of selection and its principles, an indication is given of the considerations which should influence the breeder in making selections, with a detailed description of the full procedure made use of by German selectionists and seed firms.

The various principles on which breeding rests, pure lines, the gene, etc., are explained and their relation to individual selection is discussed, followed by the use of statistical methods and variation studies, whose calculation and application are treated in some detail, leading up to a treatment of mass selection, which again leads to the problem of selection in cross-pollinated crops ; this also serves as an opportunity for an explanation of the laws and mechanism of inheritance. Experiments are described in which it was shewn that pure lines grown under rigidly standard and uniform conditions gave extremely regular seedlings and quite definite differences were observed between the different lines in respect of height after a fixed period of time ; the order of the different lines remained constant when measurements were taken at later dates and the lines were in the same order with regard to weight of seedling. Still more marked differences were observed in the respiration rate of seedlings of different lines. A discussion of the inheritance of physiological characters and the action of the gene follows from this, in which an indication is given of the extreme complication of the processes. The author describes a concept of the nature of the gene, in which a single gene is built up of several "genules" or components, all conditioning the same character but in different degrees. By alterations in the arrangement of these, changes might occur in the gene, even in a pure line, resulting in a magnification of the character in question in one member of the progeny and a diminution in another. This is offered as an explanation of yield differences which have been observed in pure lines and as a justification of the German selection methods above described, which involve a continuance of selection after pure lines have been established.

The question of cross-pollinated crops is treated more fully in a later chapter, involving an exposition of the principles of inbreeding, heterosis and self-sterility ; the latter is also explained according to the author's theory of genules, assuming that only two genes can be present in any plant, one contributed by the male and the other by the female parent, but that these genes may constitute varying combinations of genule types ("intensities") and only when the pollen and pistil are differently constituted does fertilization result.

Correlations or linkages between certain characters prevent the attainment of certain desiderata ; on the other hand the correlation of certain recondite characters with other not undesirable characters may greatly facilitate the work of the breeder. This is illustrated in the chapter on correlations, together with many other points and certain misconceptions, regarding correlations, including their statistical treatment. Many so-called correlations do not really exist at all and have never been thoroughly tested ; it often seems possible, even where a true correlation exists, to find individuals which the author refers to as "Korrelationsbrecher" in which the correlation is disobeyed : if these occur in pure lines and the correlation is an undesirable one, they are of great value.

The quality of the market product of the breeder is treated at some length—the influence of previous years' growth conditions, etc., the question of "degeneration" resulting from various causes and the multiplication of the product.

The second half of the book is devoted to the production of new types. The most direct way to accomplish this is to separate the multitudinous types which go to make up a land race ; many of these differ so widely as to constitute separate varieties.

The various uses of vegetative propagation in the multiplication and retention of new creations are dealt with in a long chapter on grafting, in which reference is also made to chimaeras, the recent production of new varieties of potatoes by means of periclinal chimaeras and to the question of graft hybrids. In the same chapter the author puts forward an explanation of mutation based on his theory of genules : a number of genules make up a gene, these genes form the chromomere or "genin" of which the chromosome or "genet" is composed. The normal haploid chromosome complement is the "genom" and the diploid somatic chromosome complement the "genont." The gene itself is compared to an enzyme, its specific reaction is regarded as being dependent not only on the nature but on the arrangement of its component parts. A mutation

results from the loss or inactivity of one or more members of the above series or from a rearrangement of them. The various types of mutations are dealt with successively. The author recommends a greater use by breeders of induced mutation and gives some practical advice on its application.

Only then does the author enter upon the question of breeding by hybridization, an explanation of the processes involved in fertilization and of the laws and mechanism of inheritance, including the characteristic features of interspecific crosses.

The author's genule theory is used to explain the phenomena of dominance and recessiveness, hybrid vigour and certain cases of complementary factors. It is questionable whether any real advantage would be gained even if it were possible to make the assumptions that the theory demands.

The book terminates with a chapter on field tests, which consists of descriptions of a number of German methods, followed by remarks on various aspects of plot tests in general and examples of their mathematical treatment.

KRÄNZLIN, G. and MARCUS, A.

633.51

Baumwolle. (Cotton.)

Wohltmann-Bücher 9, Walter Bangert, Berlin-Charlottenburg and Leipzig.

169 pp. 1931: 6 RM.

In this small handbook, which is the ninth of a series of Monographs on Tropical Agriculture, the authors have brought together general information which should be indispensable to all agriculturists or research workers concerned with the cultivation or investigation of the cotton plant.

Starting with a general account of the plant and the morphology of its vegetative and reproductive organs, the authors pass on to a brief discussion of the species and varieties, limiting the reference to those which have any agronomic importance.

The greater part of the book is taken up by general questions of cultivation but one chapter is devoted to breeding and seed production. The various characters, such as lint percentage, index and length, etc., which occupy the attention of the breeder are defined and the methods of breeding briefly reviewed. Selection methods are treated rather more fully for the sake of cultivators who are earnestly recommended to practice selection.

A special chapter is devoted to the choice of varieties and an indication is given of the growth conditions suited to each type. Further reference is made to the question in the chapter on pests and diseases.

TOBLER, F.

633.526,23

Sisal und andere Agavefasern. (Sisal and other Agave fibres.)

Wohltmann-Bücher 10, Walter Bangert, Berlin-Charlottenburg and Leipzig.

104 pp., 1931. 5 RM.

The tenth number of the series of Monographs on Tropical Agriculture of which "Cotton" (see preceding review) was the ninth. The material embraces not only the Indian and African Agaves but also those of Central and South America.

The book is arranged on lines similar to those described above for "Cotton." In the section on breeding the author discusses the existence of different races in the vegetatively propagated material and the desirability of examining these and selecting the ones most suited to any particular vicinity. A study of the Agaves in the regions of their ancient cultivation, and possibly origin, e.g. Yucatan, revealed rather marked differences between forms, closely associated with differences in ecological conditions. Great significance is attached to this from the point of view of introduction and breeding. A number of useful indications is given as to the characters on which breeding should be based. Amongst these, of rather special interest is the length of life of the plant, differences of as much as 15 years in this respect having been observed in African sisals.

The production of fertile flowers and fruits by lopping the poles is mentioned. A further obstacle in cross breeding is the unusual length of time which elapses before flowering. It is pointed out that the use of early maturing types is a disadvantage from the point of view of fibre production, although a regular system of replanting of short-lived plants would have the recommendation that the fibres produced from such plants would be of a higher quality.

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